

HISTORICAL PERSPECTIVES ON SAWAH CULTIVATION AND THE POLITICAL AND ECONOMIC CONTEXT FOR IRRIGATION IN WEST SUMATRA

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di balah balah patigo
si rauik pambalah rotan
luhak di baginyo tigo
adat di baginyo salapan
nan ampek tabang ka langik
nan ampek tingga di dunia
nan ampek tabang ka langik:
aso bulan, duo mantari,
tigo timua, ampek salatan;
nan ampek tingga di dunia:
rumah gadang, lumbuang bapereng,
sawah gadang, banda buatan

like rattan a knife has cut
into thirds,
the homeland is tripartite;
the law is divided into eight;
four flew to the heavens
four remained on earth
the four flying skyward were
the moon and the sun,
the East and the South;
the four staying on earth were
the longhouse and the granary,
the rice fields and the irrigation canals

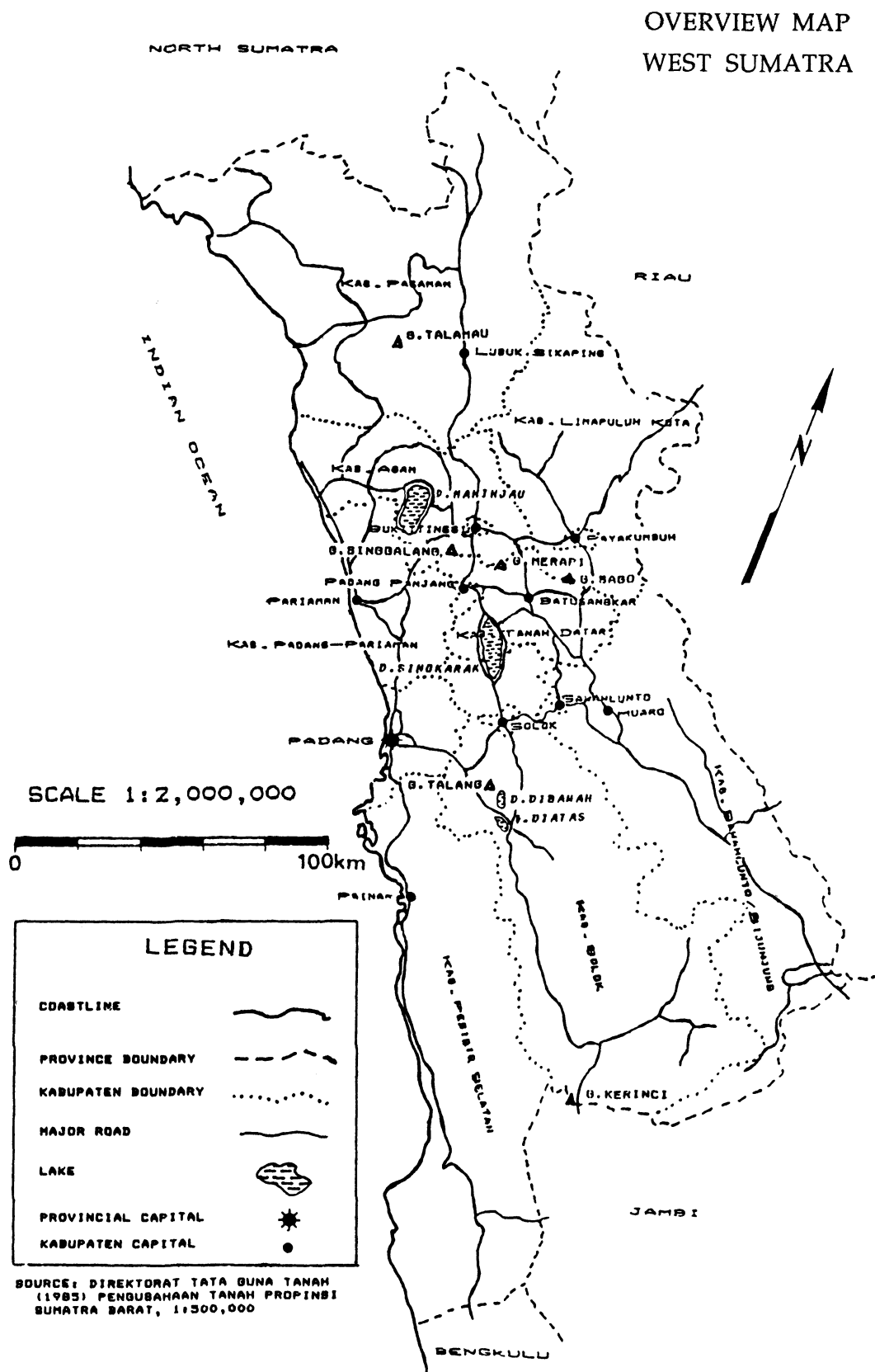
From L. C. Westenenk, *De Minangkabausche Nagari*

Introduction

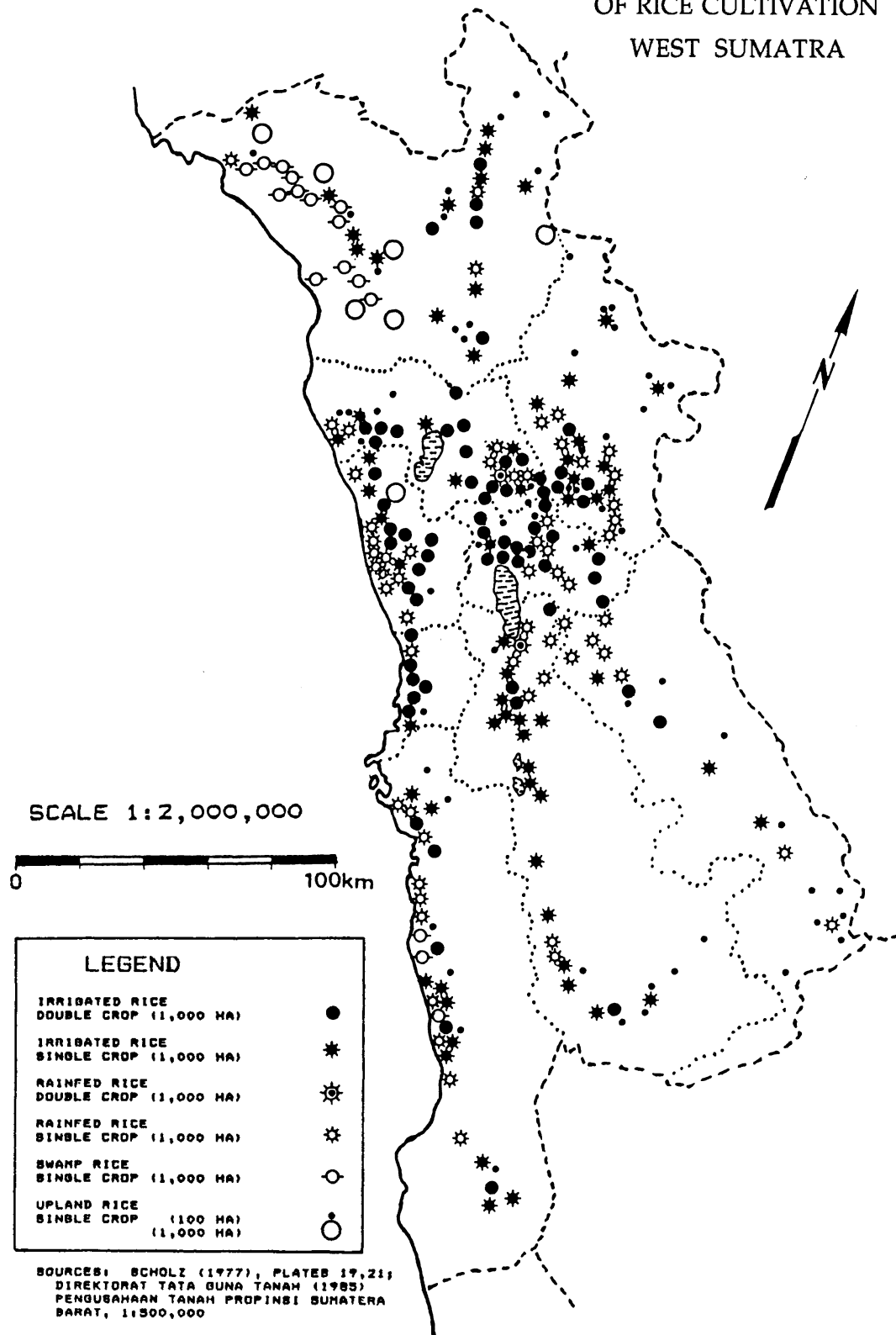
In the late 1970s Indonesia was the world's largest importer of rice. By 1984, it had attained rice self-sufficiency. This remarkable achievement was the result of favorable weather and a concerted effort on the part of the government to develop rice agriculture both on Java, the largest rice-producing area in the country, and elsewhere. West Sumatra, as one of the major rice-producing areas outside Java, has played an important part in this drive for national self-sufficiency in rice. Average yields for wet rice in the province are listed as approximately 4.4 tons per hectare.¹ These high rice yields are due not only to West Sumatra's favorable climatic conditions for wet-rice cultivation, but also to the progressive development of numerous small-scale irrigation works through a combination of farmer initiative and government assistance.

Recent efforts to improve irrigation in West Sumatra are only the latest in a long series of technical, political, and economic developments which have affected agriculture there. A number of studies have traced some of these political and economic changes, but with the exception of the coffee industry, little attention has been paid to the historical development of West Sumatra's agriculture, and none has been devoted specifically to irrigation. This lacuna is unfortunate, as irrigated *sawah* has long been the mainstay of agricultural production in the *darek*, the montane cultural homeland of the Minangkabau people. Drawing on historical and contemporary sources, this study attempts to give a preliminary history of irrigation in West Sumatra in order to examine the roles of the state and of farmers in developing what has today become a highly productive rice cultivation system.

¹ *Sumatera Barat dalam angka* (henceforth *SBDA*) 1986 (Padang: Bappeda Tingkat I Sumatera Barat and Kantor Statistik Propinsi Sumatera Barat, 1987), p. 176.



TYPE AND DISTRIBUTION OF RICE CULTIVATION WEST SUMATRA



Early History of Rice Cultivation and Irrigation

Oral Legend

Minangkabau legend says that when people began to populate the three *luhak* of the *darek* (Agam, Tanah Datar, and Limapuluh Kota), wet-rice cultivation was an early feature of their livelihood.²

dibuek sawah gadang satampang baniah
makan urang tigo luhak³

they made vast sawah and spread it with seed,
this was the food of the people of the three *luhak*

In Pariangan in western Tanah Datar, according to oral tradition, these early inhabitants established the first Minangkabau *nagari* (village), an essential Minangkabau sociopolitical-economic-territorial unit. This is presumed to have occurred in the twelfth to thirteenth centuries. According to legend, the pre-Islamic *nagari* needed at a minimum the following:

basawah baladang	wet fields and dry fields
bataratak bapanyabuangan	settlements and cockpits
badusun bagalanggan	neighborhoods and open fields
baitiak baayam	ducks and chickens
baanak bakamanakan	children and nieces
bakabau bakambiang	waterbuffalo and goats
batabek taman-taman	fishponds and gardens
bakorong bakampung	neighborhoods and villages
bacupak bagantang	customs, rules
baradat balimbago	and institutions
bataratak bakapalo koto ⁴	clearings and water sources

Here the importance of agriculture is clear, as is the distinction between wet agriculture and dry agriculture. While these legends do not allow us to specify the beginnings of irrigated agriculture in West Sumatra, they do suggest that irrigation there has both a long history and an enduring importance.

Archaeological and Linguistic Evidence

The historical record is vague about the origins of the Minangkabau and rice cultivation. Neolithic artifacts dating from as early as 2000 BC have been found in the Kerinci area along the southern border of West Sumatra. Later, peoples from China and central Indo-China came during a second migration of peoples to insular Southeast Asia around

²A longer version of this legend can be found in Taufik Abdullah, "Modernization in the Minangkabau World," in *Culture and Politics in Indonesia*, ed. Claire Holt et al. (Ithaca, N.Y.: Cornell University Press, 1972), pp. 183–86.

³Idrus Hakimy, *1000 Pepatah-petitih, mamang-bidal, pantun-gurindam* (Bandung: Remadja Karya, 1984), p. 68.

⁴L. C. Westenenk, *De Minangkabausche nagari, Mededeelingen van het Bureau voor de Bestuurszaken der Buitenbezittingen*, Aflevering XVII, 3rd. ed. (Weltevreden: Visser, 1918), p. 12.

1500–2000 BC.⁵ These people already had a vocabulary which included *huma* (cultivated field), *tebu* (sugarcane), *alu* (pestle), and *padi* (rice plant).⁶ These migrants may have introduced dry-rice cultivation to Indonesia.⁷

Wet-rice cultivation is generally presumed to have been introduced to Sumatra from Java by the Hindu-Javanese⁸ or directly from India, along with the plow, cotton, and the spinning wheel.⁹ The first Hindu settlements on the Sumatran coasts date from approximately AD 200.

Early Trade and Political Organization

There are no clues as to the state of rice cultivation until the twelfth to thirteenth century when Indian traders entered West Sumatra from the west.¹⁰ By the mid-fourteenth century they had established their own separate political-commercial center at Pariangan in the heart of the *darek*.¹¹ It may be presumed that, at least by this time, irrigation was spreading under the Indians, although it certainly could have been practiced earlier.

By 1339, the eastern Minangkabau *rantau* (fringe territories)¹² and part of the eastern *darek* had come under the control of Adityawarman, a ruler of Sumatran-Javanese parentage with ties to both the Sriwijayan empire in South Sumatra/Jambi and to the Majapahit empire in Java. At this time, gold and iron mining were already important in the central region of Tanah Datar,¹³ suggesting that agriculture may have been producing a surplus for a non-agricultural population. However, control of the gold trade, not

⁵R. Heine-Geldern, "The Archaeology and Art of Sumatra," in E. Loeb, *Sumatra, Its History and People* (Kuala Lumpur: Oxford University Press, 1982), pp. 305–31. Although Heine-Geldern's "two-wave" theory of migration to Southeast Asia is not confirmed, some recent linguistic work supports the thesis (Nordhofer, 1984, personal communication).

⁶R. Blust, "Austronesian Culture History: Some Linguistic Inferences and Their Relations to the Archeological Record," in *Miscellaneous Studies in Indonesian and Languages in Indonesia, Part III*, ed. Soepomo Poedjosoedarmo (Jakarta: Badan Penyelenggara Seri NUSA, 1977), p. 28. Rice grains dating back 6,000 years have been found on Sulawesi. See A. Whitten et. al., *The Ecology of Sumatra* (Yogyakarta: Gadjaja Mada University Press, 1984), p. 64.

⁷Heine-Geldern, "Archaeology and Art," p. 307.

⁸See L. C. Westenank, "Opstellen over Minangkabau II," *Tijdschrift voor Indische Taal-, Land- en Volkenkunde* (henceforth *TBG*) 57 (1916): 254.

⁹Whitten et al., *Ecology of Sumatra*, p. 69. However, wet-rice cultivation in Java may predate Indian influence in Indonesia. See J. Brandes, "Een jayapratta of acte van eene rechterlijke uitspraak can Caka 849," *TBG* 32 (1889).

¹⁰For information regarding developments before this time, see, *inter alia*, M. D. Mansoer et al., *Sedjarah Minangkabau* (Jakarta: Bhratara, 1970), pp. 43–44; John Miksic, "Classical Archaeology in Sumatra," *Indonesia* 30 (October 1980): 49; R. Amran, *Sumatera Barat hingga Plakat Panjang* (Jakarta: Sinar Harapan, 1981), p. 38; and E. Edwards McKinnon, "Early Politics in Southern Sumatra," *Indonesia* 40 (October 1985): 10.

¹¹Christine Dobbin, *Islamic Revivalism in a Changing Peasant Economy: Central Sumatra, 1784–1847* (London: Curzon, 1983), p. 61.

¹²Minangkabau culture also predominates in Bangkinang and the upper reaches of the Siak and Kampar Kiri rivers, which today lie in Riau but are considered part of the eastern Minangkabau *rantau*. Both the eastern and west coast *rantau* are more precisely termed *rantau dakek*, or "close *rantau*." "Close" here distinguishes them from the *rantau jauh*, or "far *rantau*," in which Minangkabau would form a minority of the inhabitants. Although the *rantau* was populated by Minangkabau, it was never a colony of the *darek*. Social structure in *rantau* territories has always been more hierarchical, especially after the subjugation of much of the coastal *rantau* by the Acehnese in the sixteenth and seventeenth centuries.

¹³Dobbin, *Islamic Revivalism*, p. 63.

of agriculture, was the economic bulwark of Adityawarman's rule.¹⁴ Although he must have been familiar with the concept of irrigation from his experience on Java,¹⁵ there is no direct evidence that he promoted irrigation in the *darek*.¹⁶ However, the probability is high that by the fourteenth century irrigated rice cultivation was spreading in highland West Sumatra under the influence of Adityawarman in eastern Tanah Datar and of the Indians in western Tanah Datar.

Whatever their roles in irrigation development, neither Adityawarman nor the Indians constituted a centralized authority able to undertake large irrigation works. The topography of West Sumatra allows for the development of many small systems and does not necessitate large irrigation works with correspondingly large command areas. This has enabled irrigation production systems to be relatively independent and small in scale, without the need for a large superordinant political structure to organize the construction and maintenance of the physical systems and provide political stability for their operation. The decentralized production base in West Sumatra did not encourage the development of centralized rule, in contradistinction to Java, and it contributed to the viability of semi-autonomous *nagari* rule. After Adityawarman's death, his weakened dynasty appears to have had little control over the administration of *nagari* affairs.¹⁷ Irrigation matters were probably handled by the *nagari*, to the extent that any group beyond the irrigators themselves was involved.

Lack of evidence precludes speculation on the state of irrigation during the centuries immediately following Adityawarman's time. By the seventeenth century, however, we may infer its state in West Sumatra by examining what was happening in Malaya across the Straits of Malacca. Beginning in the fifteenth century, significant numbers of migrants from West Sumatra moved to the west coast of Malaysia. Many settled in Negeri Sembilan, which in the late eighteenth century was closely linked culturally and politically with Minangkabau.¹⁸

¹⁴Ibid., p. 62. Claims that Adityawarman emphasized the agricultural sector (see DPK, *Sejarah Sumatera Barat* [Jakarta: DP&K, 1978], p. 46) are suspect, given that he situated his capital in the heart of the gold-producing regions, not in the major rice-producing regions. Note also that the inscription on his gravestone, "kanakamedinindra," means "king of the gold-bearing lands." See H. Kern, "Grafsteenopschrift van Koeboer Radja," *Bijdragen tot de Taal-, Land- en Volkenkunde van Nederlandsch-Indië* (henceforth *BKI*) 67 (1913): 401-4.

¹⁵The earliest known irrigation structure in Indonesia is the Harinjing weir in East Java mentioned in an inscription dated AD 804. See Abdullah Angoedi, *Sejarah irigasi di Indonesia 1* (Jakarta: Komite Nasional Indonesia, International Commission on Irrigation and Drainage, 1985), p. 28. Irrigation systems are also mentioned in fourteenth century inscriptions from the Singosari Dynasty in East Java. See T. Pigeaud, *Java in the 14th Century* (The Hague: Martinus Nijhoff, 1963).

¹⁶In Saruaso a stone stele from Adityawarman's time was found by the side of an irrigation canal today called "Banda Bapahek," "The Chiseled Canal." The inscription has not been translated (See, P. Hardjowardjojo, *Adityawarman, Sebuah studi tentang tokoh nasional dari abad XIV* [Jakarta: Bhatara, 1966], pp. 21-22), making it difficult to tell what relationship this stele may have to the irrigation system itself. Other inscriptions from Adityawarman's time deal only with religion, kingship, and genealogy, so it is unlikely that this one deals directly with irrigation. Cf. Satyawati Suleiman, "The Archaeology and History of West Sumatra," *Bulletin of the Research Centre of Archaeology of Indonesia*, No. 12 (Jakarta: Pusat Penelitian Purbakala dan Peninggalan Nasional, 1977), p. 5.

¹⁷The rule of the dynasty was most centralized during its first seventy years. In 1409, an expedition sent by the Majapahit empire to bring the renegade kingdom to heel attacked the Pagarruyung kingdom. Although the Pagarruyung forces prevailed, the attack apparently weakened the monarchic forces and precipitated a return to primarily *nagari* rule. See DPK, *Sejarah Sumatera Barat*, pp. 39-49.

¹⁸Considerable numbers of Minangkabau had already settled in the region by the early seventeenth century and may have been the dominant ethnic group in the state up to two centuries before that. From 1770 until

Although at that time, the Malays in peninsular Malaysia planted only dry rice, irrigation appears to have been widespread among the Minangkabau migrants in the inland valleys of Negeri Sembilan.¹⁹ Because neighboring areas (Malacca, Kelantan, Trengganu, and Pahang) cultivated primarily unirrigated rice, it appears likely that the irrigation technology of the Minangkabau in Malaya was brought over from the *darek* in West Sumatra, not initially developed locally.²⁰ As recently as the late nineteenth century, in Malacca it was only the Minangkabau who irrigated rice; the Malaccans themselves relied entirely on the southwest monsoon to water their rice crop.²¹ Thus, certainly by the 1700s it appears that irrigation had become such an integral part of Minangkabau culture that Minangkabau emigrants transferred it to their new homes as well.

From 1803 to 1833 the *darek* was embroiled in civil war stemming from a political-religious confrontation between a fundamentalist Islamic group called the Padri and the more syncretist groups tied to traditional elite families and to the court at Pagarruyung. During this period of proselytization by the sword, slave raiding, crop burning, and trade route closures were common, suggesting that conditions were temporarily unfavorable for cultivating irrigated and non-irrigated fields alike. In some Padri areas, such as Lintau in eastern Tanah Datar, irrigation development took place under the direction of Padri war commanders (*hulubalang*), but these were only incremental improvements to existing irrigation. Christine Dobbin gives an excellent account of the turmoil of these years in her *Islamic Revivalism*. The Dutch, who from the mid-1600s had established themselves as traders on the western coast, soon proceeded to subdue the Padri and advance their own colonial designs. The Dutch territorial conquest of West Sumatra, completed in 1837, restored the civil stability necessary for productive *sawah* cultivation, but it carried the price of village autonomy and ushered in the first era of major state intervention in agriculture.

Early Travelers' References to Sawah

The first European to reach the *darek* was Thomas Dias, a Portuguese emissary in the employ of the Dutch governor of Malacca. He entered the region from the east in 1684, emerging in Lintau in eastern Tanah Datar after an arduous journey through mountainous jungle.²² Dias mentions gold panning and agriculture as the principal occupations in Tanah Datar, but gives no details on agriculture, as he was more interested in political conditions at Kumanis, the seat of the royal family at the time. His mention of a population of 8,000 at Kumanis and of 3,000 armed soldiers sent by the king to see him

1830 Negeri Sembilan was ruled directly by Minangkabau princes sent from the *darek*. See P. de Josselin de Jong, *Minangkabau and Negeri Sembilan* (The Hague: Nijhoff, 1952), pp. 120–21.

¹⁹Mohammed bin Halib, "The State, Rice, and Irrigation: Historical Development and Contemporary Cases of Small-scale Irrigation Systems in Peninsular Malaysia" (Ph.D. dissertation, Cornell University, 1985), pp. 31–45; and J. Jackson, "Rice Cultivation in West Malaysia," *Journal of the Malaysian Branch of the Royal Asiatic Society* 45, 2 (1972): 78–79.

²⁰For a description of local *sawah* cultivation, see D. H. Grist, "Wet Padi Planting in Negri Sembilan," Bulletin no. 33, Department of Agriculture, Federated Malay States, 1922, p. 1; and Jackson, "Rice Cultivation," pp. 76–96.

²¹Bin Halib, "State, Rice, and Irrigation," p. 43.

²²F. de Haan, "Naar Midden Sumatra in 1684," *TBC* 39 (1897): 327–66.

off suggest, however, that agriculture in the region was sustaining a substantial number of people even three hundred years ago.²³

In the late eighteenth century William Marsden gave descriptions of *sawah* and *padi ladang* cultivation in Sumatra.²⁴ With regard to *sawah*, he mentions that irrigation was sometimes used:

Sawahs are plantations of *padi* in low, wet ground, which, during the growth of the crop, in the rainy season between the months of October and March, are for the most part overflowed to a depth of six inches or a foot, beyond which latter the water becomes prejudicial. Leve marshes, of firm bottom, under a moderate stratum of mud, and not liable to deep stagnant water, are the situations preferred; the narrower hollows, though very commonly used for small plantations, being more liable to accidents from torrents and too great depth of water, which the inhabitants have rarely industry enough to regulate to advantage by permanent embankments. They are not, however, ignorant of such expedients, and works are sometimes met with, constructed for the purpose, chiefly, of supplying the deficiency of rain to several adjoining sawahs, by means of sluices, contrived with no small degree of skill and attention to levels. . . .

. . . Through these apertures [*anicuts*] water is also, in some instances, introduced from adjacent rivers or reservoirs, where such exist, and the season requires their aid. The innumerable springs and rivulets with which this country abounds, render unnecessary the laborious process by which water is raised and supplied to the rice grounds in the western part of India, where the soil is sandy: yet still the principal art of the planter consists, and is required, in the management of this article; to furnish it to the ground in proper and moderate quantities, and to carry it off from time to time by drains; for if suffered to be long stagnant, it would occasion the grain to rot.²⁵

The first Westerner known to have entered the *darek* from the west was Sir Thomas Stamford Raffles. In 1818, during the British interregnum in West Sumatra (1795–1819), he journeyed inland from Padang to Pagarruyung near Batusangkar.²⁶ Raffles made the first detailed observations on the state of agriculture in West Sumatra. Excerpts from his diary reveal that he was impressed with the sophistication of agricultural techniques in the *darek*—in this case near Solok:

. . . we had a gratifying view of the Tiga-blas country, an extensive and highly cultivated plain, bounded to the south by the noble mountain of Talang. . . . The whole of the plain, or valley, (I hardly know which to call it,) occupied by the *Tiga-blas Cotas*, or *Thirteen Confederate Towns*, is one sheet of cultivation; in breadth it may be about ten, and in length twenty miles, thickly studded with towns and villages, some of them running in a connected line for several miles. . . . On the slopes of the hills, the principal cultivation is coffee, indigo, maize, sugar-cane, and the oil-giving plants; on the plain below, almost exclusively rice. The sawas, or rice-fields, are here managed exactly on the principle of the mountain sawas in Java, and the soil and produce seem equally good. . . . The Tiga-blas country has always been famed for its

²³*Ibid.*, pp. 341–44. An English account of Dias' remarkable journey can be found in E. Schnitger, *Forgotten Kingdoms in Sumatra* (Leiden: Brill, 1939), pp. 30–31.

²⁴W. Marsden, *The History of Sumatra* (3rd ed. 1811; reprint Singapore: Oxford University Press, 1986), pp. 65–78.

²⁵*Ibid.*, pp. 73–75.

²⁶See Lady Sophia Raffles, *Memoir of the Life and Public Services of Sir Thomas Stamford Raffles* (London: Murray, 1830), pp. 339–66.

produce in gold; indeed to Europeans it has been known as a gold country alone. To find it also in a high degree agricultural was more than I expected . . . many parts reminded us of the beautiful district of Serayu, the pride of Java.²⁷

Raffles goes on to paint in glowing terms a picture of Tanah Datar and the southern slopes of Mt. Merapi:

The whole side of the mountain, for about fifteen miles from Pageruyong in every direction, being covered with villages and rice-fields. . . . The whole country, from Pageruyong as far as the eye could distinctly trace, was one continued scene of cultivation, interspersed with innumerable towns and villages, shaded by the cocoa-nut and other fruit trees. I may safely say, that this view equalled any thing I ever saw in Java; the scenery is more majestic and grand, population equally dense, cultivation equally rich. In a comparison with the plain of Matarun, the richest part of Java, I think it would rise.²⁸

By the early 1800s, shifting cultivation had been replaced by permanent agriculture in most of the *darek*, and the highlanders were said to be quite advanced in the positioning of waterworks.²⁹ At this time, the *darek* was already supporting a large population, and its people had achieved considerable fluency in animal husbandry, metalworking, and carpentry, as well as in agricultural techniques.³⁰

Summary

Rice cultivation has long been practiced in West Sumatra, and irrigation techniques in the *darek* have been refined over a period of centuries. Because rainfall is abundant, the incentive to develop irrigation has not been as high in West Sumatra as in many other areas of the world. Nonetheless, irrigation water was still harnessed to supplement rainfall during the rainy season, particularly in the highlands of West Sumatra. Because of the long history of irrigation in the area, we may, like Marsden and Raffles nearly two hundred years ago, assume that irrigators had, long before modern times, achieved considerable proficiency in water management in thousands of small, local irrigation systems.³¹

This discussion of the development of irrigation in West Sumatra should not necessarily be extended to include all other areas of Sumatra. Areas with a long history of irrigation in Sumatra are generally limited to those located in the Bukit Barisan mountains which run the length of the island. Thus, there are examples of sophisticated irrigation

²⁷Ibid., pp. 348–49, 351. Emphasis in the original.

²⁸Ibid., pp. 359–60.

²⁹A. Pruys van der Hoeven, *Een word over Sumatra* (Rotterdam: Nijgh, 1864), vol. 2, *Sumatra's Westkust en Palembang*, p. 38.

³⁰Raffles marveled at the ingenuity of irrigation water wheels he encountered and of cattle-powered sugar presses, neither of which he had seen in Java.

³¹Later authors also remarked on the wealth of small streams in the region and the ingenuity of the farmers in constructing and aligning canals to bring that water to the desired locations. See, for example, P. Couperus, "Aanteekeningen omtrent de landbouwkundige nijverheid in de Residentie Padangsche Bovenlanden," *TBG* 5 (1856): 285–312.

technology from mountainous areas in Aceh,³² North Sumatra,³³ and parts of South Sumatra.³⁴ For many of the flatter parts of the island, however, good water control is the exception rather than the rule.³⁵

The Political and Economic Context for Irrigation Development since the Coming of the Dutch (1821–1985)

Economic and political forces bearing on irrigation can be traced more clearly after the Dutch occupation of the central highlands beginning in the 1820s. However, many details are still unknown and many inferences about the state and processes of early irrigation must be made based on what is known more generally about rice cultivation and local political conditions.

Beginning with the colonial era, it is useful to distinguish several historical periods in West Sumatra: (a) a time of Dutch consolidation of their political and economic control from 1821 until the introduction of a system of forced cultivation of coffee (the *koffiestelsel*) in 1847; (b) the *koffiestelsel* (1847–1908); (c) a period of booming commodity markets (1908–1929); (d) the world economic depression (1929–1942); (e) World War II and the struggle for independence (1943–1950); and (f) the post-colonial years (1950–present).

1821–1847: Consolidation of Dutch Power in West Sumatra

Military conquest. Although the Dutch had been active for over 150 years in trading for the products of West Sumatra via west coast ports, it was not until the 1820s that they began to assume direct control over the countryside. Taking advantage of the civil unrest of the Padri war, the Dutch sided with the “traditionalists” and launched a series of military expeditions into the *darek*, beginning in 1822 and culminating in the defeat of the last Padri forces in 1837.³⁶ Despite periodic uprisings during the next few years, by the

³²See, for example, Pusat Pengembangan Agribisnis, “Seminar Pengembangan irigasi sederhana,” Banda Aceh, December 13–15, 1987 (Jakarta: Pusat Pengembangan Agribisnis).

³³See, for example, R. Lando, “The Gift of Land” (Ph.D. dissertation, University of California at Riverside, 1979); J. Keuning, “Over bevoelingsleidingen (bondars) in de Onderafdeeling Toba,” *Koloniale Tijdschrift* (henceforth *KT*) 28, 3 (1939): 273–81; and J. Haar, “De ‘Panriahan-Pamokkahan’ in Simeloengoen,” *Koloniale Studien* (henceforth *KS*) 20, 1 (1936): 25–50.

³⁴See, for example, Pusat Penelitian Universitas Sriwijaya, “Pola dan Dampak Bantuan Pemerintah Terhadap Organisasi Irigasi Tradisional: Pengalaman Desa Tanjung Agung, Sumatera Selatan,” Paper presented to the Workshop on Government Assistance to Traditional Irrigation Systems, Bukittinggi, West Sumatra, 1984.

³⁵A recent study shows that irrigation is now concentrated in West and North Sumatra, Aceh, and Lampung, and in parts of Bengkulu and South Sumatra. Rainfed *sawah* is considerable in Aceh and North Sumatra, while tidally irrigated rice (*pasang surut*), deepwater rice (*lebak*), and the majority of swamp rice (*rawa*) are found in Jambi and South Sumatra. In Sumatra as a whole, 46 percent of *sawah* is irrigated, 26 percent is rainfed, 15 percent is swamp and deepwater, and 13 percent is tidal. See, U. Scholz et al., *The Natural Regions of Sumatra and Their Agricultural Production Pattern* (Bogor: Central Research Institute for Food Crops, Ministry of Agriculture, 1983), 1:22–28; and 2: map 7.

³⁶Mansoer et al., *Sedjarah Minangkabau*, pp. 132–44. In 1821 Dutch officials in Padang obtained a document signed by some self-styled nobles from Pagarryung which ceded the Minangkabau “kingdom” to the Dutch. However, this *pactum in illicito* carried no authority. See Elizabeth Graves, *The Minangkabau Response to Dutch Colonial Rule in the Nineteenth Century* (Ithaca, N.Y.: Cornell Modern Indonesia Project, 1981), pp. 35–37.

mid-1840s West Sumatra was firmly in the hands of the Dutch. During these early years the Dutch were more occupied with military and security considerations than with agriculture,³⁷ although in the rice sector they did temporarily ban the export of rice to lower its price and the cost of garrisoning troops.³⁸

In order to increase military security and to redirect highland trade from traditional eastern river routes to the Dutch-controlled west coast, the Dutch built roads linking highland towns to the coast. These roads facilitated an expansion of commercial activity between the *darek* and the west coast which could more easily handle bulky agricultural products, such as coffee, which the colonial government wished to promote. The upgrading of the Anai gorge road to accommodate wheeled transport in the 1840s also allowed easier marketing of highland rice to coastal markets.³⁹

Early in their administration of West Sumatra, the Dutch began symbolically inaugurating the beginning of each year's rice cultivation cycle. Much like the king of Thailand who presides over the first breaking of the ground and signals the start of the cropping season for his subjects, the Dutch "graced" the annual opening of an irrigation system at Pauh near Padang. During his journey in 1818, Raffles had remarked on an elaborate irrigation ceremony here, but he failed to mention whether it was conducted wholly at the instigation of the people of Pauh, or whether it was done under the auspices of one of the coastal princes.⁴⁰ In any case, the Dutch began paying for the ceremony and took over its leadership. The Dutch Resident (Governor) with a retinue of officials and a company of soldiers attended two feasts here, one at the opening of the canal for land preparation and another two weeks later when the fields were ready for plowing.⁴¹ The authorities used the occasion to link their administration ritually to rice cultivation, so important symbolically and economically to the Minangkabau. Special ritual paraphernalia with regal overtones, such as a golden hoe, were later added to enhance the occasion. The Dutch continued this tradition until the end of the colonial period.⁴²

The encouragement of coffee cultivation. With the depletion of local gold reserves in the late 1700s the Dutch realized they would have to seek other resources to make their new territory financially solvent. Coffee trade was a logical replacement. Coffee prices were attractive, and the well-drained volcanic soil, high rainfall, and cooler weather of the highland plateaus and mountains in West Sumatra made it an ideal crop agronomically.

Coffee was not the first commercial crop the Minangkabau had grown. They had a long history of developing commercial agriculture in response to European market possibilities: first in pepper in the sixteenth and seventeenth centuries, next in cinnamon (*cassia vera*) and *gambir*, and then in coffee beginning in the 1780s.⁴³ Even before their

Dutch Colonial Rule in the Nineteenth Century (Ithaca, N.Y.: Cornell Modern Indonesia Project, 1981), pp. 35–37.

³⁷See, for example, E. B. Kielstra, "Sumatra's Westkust van 1819–1825," *BKI* 36 (1887): 8–163.

³⁸Akira Oki, "Social Change in the West Sumatran Village, 1908–1945" (Ph.D. dissertation, Australian National University, 1977), p. 39.

³⁹Dobbin, *Islamic Revivalism*, pp. 213, 232; and T. Kato, "Rantau Pariaman," *Journal of Asian Studies* 39, 4 (1980): 743 ff.

⁴⁰Raffles, *Memoir of the Life*, p. 344. It may have formerly been attended by the Tuanku Panglima of Padang. Cf. S. Müller, *Bijdragen tot de kennis van Sumatra* (Leiden: Luchtmans, 1846), pp. 159–63.

⁴¹Müller, *Bijdragen tot de kennis van Sumatra*, pp. 159–63.

⁴²See "Pemboekaan Kepala Bandar di Loeb. Begaloeng," *Soerat Chabar Pengoesahaan Tanah* (hereafter SCPT) 10, 12 (June 1937): 134–35.

⁴³Dobbin, *Islamic Revivalism*, p. 35.

military conquest, the Dutch had been promoting coffee cultivation in the highlands by paying a commission to *pangulu*, traditional family clan leaders, who could deliver coffee to Dutch buyers on the coast.⁴⁴

Up to 1833, trade in coffee was completely free except for the right to export.⁴⁵ However, the colonial authorities disliked their dependence on Minangkabau traders and planned instead to institute a forced cultivation system for coffee, patterned on the *cultuurstelsel* program they had instituted in Java for coffee and sugarcane in 1830.⁴⁶ With the subjugation of Sungai Pagu in southern West Sumatra in 1845, the pacification of the Minangkabau was largely complete and they began to pursue that plan in earnest.⁴⁷

Coffee and rice have different soil and drainage requirements so they do not compete for land. They do, however, compete for labor. As a result of their commercial experience with gold and agricultural products, by the early 1800s the Minangkabau were probably already paying attention to the issue of returns to labor and evaluating which crop should receive the most attention. They still needed to plant sufficient *sawah* to ensure self-subsistence in the absence of fluid rice markets and to maintain the prestige of the *pangulu*, but the Minangkabau were eager to make profits from coffee as well. In the early days of the coffee boom some regions pursued both coffee and *sawah* cultivation with equal vigor. For example, a Dutch official remarked in 1844 that Limapuluh Kota was not only active in cultivating coffee but also produced a rice surplus for Agam.⁴⁸

Village administrative reorganization. Before colonial rule the Minangkabau village, the *nagari*, had been essentially autonomous. However, after their first conquests in West Sumatra, the Dutch began creating a superstructure of administration which radically departed from the model of the autonomous *nagari*.

First, beginning in 1823 each village was provided with its own head, the *nagari-hoofd*. Above the *nagari* the Dutch created districts called *laras*, each with its own head or *larashoofd*,⁴⁹ which were formed from clusters of adjacent *nagari* usually with loose *adat* ties. *Laras* were combined into regencies, and the regencies into two residencies.⁵⁰

Second, the Dutch began a process of creating a power hierarchy within the *nagari*. One of the characteristics of Minangkabau society had been an emphasis on shared power for all *pangulu* in a *nagari*.⁵¹ Europeans, however, found this system unwieldy. For example, on his journey into the *darek* in 1818 Raffles lamented having to deal with "some hundreds" of equally powerful *pangulu* merely to get permission for his party to cross *nagari* lands.⁵² An early Dutch writer wrote, "Many times we have tried to convince the Malays how difficult it was to deal with the *suku* (extended family) administration and how imperative it was to replace it with a hierarchical multi-level

⁴⁴Graves, *Minangkabau Response*, p. 35.

⁴⁵W. K. Huitema, *De bevolkingskoffiecultuur op Sumatra* (Wageningen: Veenman, 1935), p. 59.

⁴⁶See, for example, Clifford Geertz, *Agricultural Involution* (Berkeley: University of California Press, 1963), pp. 63 ff.

⁴⁷Dobbin, *Islamic Revivalism*, p. 213.

⁴⁸Granpré Molière, in *ibid.*, p. 135.

⁴⁹Amran, *Sumatera Barat*, p. 75, n. 63; and W. J. Leyds, "Larassen in Minangkabau," *KS* 10, 1 (1926): 398.

⁵⁰DPK, *Sejarah Sumatera Barat*, p. 81.

⁵¹Strictly this applies only to *nagari* following the Bodi-Caniago tradition of leadership. *Nagari* following the Koto-Piliang tradition elevate one *pangulu* above the rest, but even he must make decisions via consensus with the other *pangulu*. Other minor distinctions between *pangulu* during the early nineteenth century are detailed in Dobbin, *Islamic Revivalism*.

⁵²Raffles, *Memoir of the Life*, p. 350.

form of government."⁵³ One observer later expressed the Dutch sentiment well when he wrote that "Minangkabau traditional democratic government . . . was not compatible with the modern needs of centralization and the creation of a professional cadre of civil servants."⁵⁴

The Dutch found it advantageous to stratify the governance and the elite of the *nagari* to obtain *corvée* labor for road building and other projects.⁵⁵ They began to institute regulations to increase the power of *pangulu* in administrative positions and to separate them from ordinary *pangulu*. Furthermore, a deliberate effort was made to tie the economic fortunes of these *pangulu* and their lineages to cooperation with the Dutch. This reduced interlineage competition for *pangulu* positions and resulted in an ossification of the titles, which certain families then monopolized through the generations.⁵⁶ Later, beginning in 1888, the Dutch also tried to limit the number of *pangulu*, because the policy of exempting *pangulu* from compulsory labor precipitated a proliferation in *pangulu*-ships.⁵⁷ This led to considerable disruption in the administration of communal lands, because new *pangulu* could no longer be created to represent new family segmentations, and disputes about inheritance and redistribution of land abounded.⁵⁸ From early times, government-appointed *pangulu* began abusing their new powers,⁵⁹ and abuse of power was to become an even more serious problem during the period of forced coffee cultivation.

1847–1908: Mandatory Coffee Cultivation

The koffiestelsel. In 1847, the Dutch unilaterally abrogated the "Plakaat Panjang," a document signed by Governor-General van den Bosch during his visit to West Sumatra in 1833, which promised that the Dutch government would neither interfere with traditional institutions nor dictate to whom the farmer must sell his crops.⁶⁰ In contravention of this promise they introduced the *koffiestelsel*, a compulsory coffee cultivation and delivery system. Farmers, in all regions with suitable climate and soils, were compelled to plant and maintain coffee trees and to sell the produce for cash at Dutch warehouses.⁶¹

The success of the *koffiestelsel* depended on a well-defined village administrative hierarchy, which at each level could control lower levels and be held accountable to

⁵³E. Francis, "Korte beschrijving van het Nederlandsch grondgebied ter Westkust van Sumatra, 1837," *Tijdschrift voor Nederlandsch-Indie* (henceforth *TNI*) 2 (1839): 128. Translation in F. and K. von Benda-Beckmann, "Transformation and Change in Minangkabau," in *Change and Continuity in Minangkabau*, ed. L. L. Thomas and F. von Benda-Beckmann, Monographs in International Studies No. 71 (Athens, Ohio: Ohio University MIS, 1985), p. 255.

⁵⁴C. Lekkerkerker, *Land en volk van Sumatra* (Leiden: Brill, 1916), p. 140.

⁵⁵Dobbin, *Islamic Revivalism*, p. 196.

⁵⁶*Ibid.*, p. 233.

⁵⁷B. Schrieke, *Indonesian Sociological Studies: The Selected Writings of B. Schrieke* (Bandung: Sumur Bandung, 1960), p. 135; A. van Hasselt, *Volksbeschrijving van Midden-Sumatra* (Leiden: Brill, 1882), p. 190; Lekkerkerker, *Land en volk*, p. 141.

⁵⁸See F. and K. von Benda-Beckmann, "Transformation and Change," pp. 259–60.

⁵⁹Francis, "Korte beschrijving," p. 128.

⁶⁰An Indonesian text of the Plakaat Panjang can be found in Kementerian Penerangan, *Propinsi Sumatera Tengah* (Jakarta: Kementerian Penerangan, 1954), pp. 318–22.

⁶¹D. Ples, *De koffij-cultuur op Sumatra's Westkust* (Batavia: Ogilvie, 1878), pp. 15–16.

Dutch authorities above. By 1847 the Dutch had succeeded both in pacifying the region and in creating this hierarchy.

In 1852 West Sumatra first began to show a net profit for the colonial government, mostly due to the Dutch coffee monopoly.⁶² However, unlike the period of relatively free trade before 1847, profits to the coffee cultivators were only one-half to one-fourth of the price the Dutch obtained on resale,⁶³ and the government eventually had to use coercion to achieve planting and production quotas.⁶⁴ Farmers tried to evade work in the coffee gardens, while the Dutch and village elites strained to keep them cultivating coffee. The dynamic, market-oriented society of the precolonial era was suppressed as the economy stagnated under the *koffiestelsel* and the former patterns of traditional elite fluidity ossified.⁶⁵ By the 1870s, coffee exports were plummeting, and although the government took such measures as increasing the percentage of the harvest the *pangulu* were allowed to keep for themselves,⁶⁶ the system had become unworkable because farmers refused to tend their coffee trees.

Implications for sawah cultivation. During the 1850s and early 1860s West Sumatra was a modest net exporter of rice, in addition to being fully engaged in coffee production.⁶⁷ The Dutch, however, favored coffee because they had monopolized the coffee trade, so their profits were greater from coffee than from rice. The Dutch did not encourage coffee production to the exclusion of rice production, for sufficient rice production to supply subsistence needs was still essential to the success of the *koffiestelsel*. However, low rice prices also spurred coffee production.⁶⁸ By restricting the rice sector to subsistence levels and insulating it from cash transactions, the Dutch were also able to dictate low prices for coffee producers and reap large profits through exports.⁶⁹ Encouraging rice exports would have undermined Dutch control over coffee by providing an alternative source of cash for the Minangkabau farmer.

On the other hand, the Dutch did wish to avoid importing rice. As early as 1847 they punished farmers who neglected rice cultivation.⁷⁰ As rice production during the *koffiestelsel* began to fall, the Dutch experimented with rice varieties and techniques imported from Java and the Carolinas.⁷¹ However, when West Sumatra became a rice importer in

⁶²"De financiële resultaten van het bestuur der Buitenbezittingen van 1839 tot 1862," *Indische Gids* (henceforth IG) 33a (1890): 1337.

⁶³Prices for coffee realized by the Dutch exceeded those paid to coffee producers by an ever-increasing margin throughout the *koffiestelsel*. See U. Scholz, *Minangkabau: Die agrarstruktur in West-Sumatra und moeglichkeiten ihrer entwicklung* (Geissen: Geographischen Instituts der Justus Liebig-Universitaet, 1977), p. 56; and Amran, *Sumatera Barat*, p. 350.

⁶⁴Graves, *Minangkabau Response*, pp. 63–65.

⁶⁵See F. and K. von Benda-Beckmann, "Transformation and Change"; and J. Haggis et al., "By the Teeth: A Critical Examination of James Scott's *The Moral Economy of the Peasant*," *World Development* 14, 12 (1986): 1435–55.

⁶⁶Huitema, *De bevolkingskoffiecultuur*, p. 59.

⁶⁷J. Veth, *Aardrijkskundig en statistisch woordenboek van Nederlandsch Indië* (Amsterdam: Van Kampen, 1869), 3:732.

⁶⁸Couperus, "Aanteekeningen," p. 304.

⁶⁹See, for example, Joel Kahn, "Commercialization and Change in Minangkabau," in *Change and Continuity in Minangkabau*, ed. Thomas and von Benda-Beckmann, p. 283.

⁷⁰Oki, "Social Change," p. 30. Farmers in Lintau Buo recalled punishments for not following the *plakaat sawah*, such as being paraded through the village while being forced to carry stones on the head. See also Schrieke, *Indonesian Sociological Studies*, p. 146.

⁷¹Couperus, "Aanteekeningen," p. 292; and, B. van Hoëvell, "Over ijle uitzaaiing van Carolina rijst op Sumatra," *Tijdschrift voor Nijverheid en Landbouw in Nederlandsch-Indië* (henceforth TNLNI) 19 (1874): 130–32.

the late 1800s, increased Dutch attention to the rice sector was still aimed at ensuring adequate harvests to avoid famine, not at developing the potential to export rice.⁷²

The status of exports of rice from Padang is shown in Table 1.

Table 1. Milled Rice Exports from Padang, 1858–1908

Year	Rice Exports (yearly average in 000 metric tons)
1858–1862	3562
1863–1867	2292
1868–1872	52
1873–1877	273
1878–1882	832
1883–1887	5
1888–1892	3
1893–1897	0
1898–1902	0
1903–1908	0

Source: *Verslag van den Kamer van Koophandel en Nijverheid te Padang (VKK)*, various issues.

Note: These figure refer only to the rice trade via the port of Padang. While Padang was the most active port on the west coast, rice also moved in and out of the west coast ports of Air Bangis, Pariaman, Painan, Air Haji, and Indrapura. Estimates of the rice trade through these ports for the years 1907–1911 can be found in J. van Tubergen, *Verslag over de Burgelijke Openbare Werken in Nederlandsch-Indië over het jaar 1913* (Batavia: Papyrus, 1916), p. 136. Estimating the total rice balance in the province is further complicated by the existence of rice exports via eastern trade routes. Although these appear to have been very small after the 1850s, they nonetheless should also enter into a thorough calculation.

By the early 1890s, Dutch policies had resulted in the complete disappearance of rice exports via Padang. Besides low rice prices and forced labor in the coffee gardens, from the mid-1800s a series of other Dutch policies also acted to constrain the development of the rice economy. One example was an epidemic among draft animals in 1866/1867 which resulted from corralling them to free pasture lands for coffee cultivation.⁷³ The ensuing shortage of draft animals for cultivation reduced production and caused a temporary end to rice exports from the region.

⁷²Schrieke, *Indonesian Sociological Studies*, pp. 97–98.

⁷³A. Verkerk Pistorius, *Studien over de inlandsche huishouding in de Padangsche Bovenlanden* (Zalt-Bommel: Noman, 1871), pp. 176–77. As a result of the epidemic, the number of buffalo dropped from 178,00 in 1863 to about 98,000, while the number of cattle fell from 122,000 in 1863 to about 68,000. See Veth, *Aardrijkskundig en statistisch woordenboek*, p. 707; and Z. Kamerling, "De toekomst van Sumatra," *TNLNI* 71 (1905): 502. Lack of pasture for draft animals continued to be a problem into the twentieth century. See *Verslag van den economischen toestand der inlandsche bevolking*, 1924, vol. 2 (Weltevreden: Landsdrukkerij, 1926), p. 197.

Forced labor for coffee gardens, low rice prices, and a government ban on rice exports from West Sumatra also contributed to a drop in rice production.⁷⁴ Further official discrimination against rice was evidenced by the deliberate inattention to the development of eastern transportation links to Jambi and Riau, traditional markets for Minangkabau rice, and even the desire of at least one Dutch Resident in the highlands to abolish water-driven rice mills because they facilitated the production of a surplus.⁷⁵ With the opening of shipping links between Padang and non-Indonesian ports in 1879, rice could be brought in from Thailand, Burma, and Indochina, which undercut local prices.⁷⁶ Another indication of the inattention of the Dutch to Minangkabau rice production is the conspicuous dearth of statistics on the production and planted area of rice in West Sumatra during the nineteenth century—a time when they were vigorously collecting detailed statistics on all crops with an export market.⁷⁷ West Sumatra would not become a net exporter of rice again until the 1910s.⁷⁸

The *koffiestelsel* and attendant rice policies affected both highland villages and villages in the large, flatter *sawah* plains. Most of the major rice-producing regions, such as Ampek Angkek Canduang near Bukittinggi; Guguk and Luhak in Limapuluh Kota; and Selayo, Cupak, and Muara Panas in Solok were relatively unaffected by the *koffiestelsel*.⁷⁹ However, these areas suffered from the ban on rice export, and many *sawah* fields not needed for household consumption in the rice plains were said to have been abandoned at the end of the nineteenth century.⁸⁰

Probably most directly affected by the *koffiestelsel* was irrigated agriculture in the small valleys surrounded by slopes suitable for coffee cultivation.⁸¹ These were areas where per capita production of coffee was highest—northern and southern Tanah Datar, northern and eastern Limapuluh Kota, northern Agam, Lubuk Sikaping, and eastern and southern Solok.⁸² It is also from these areas that large-scale outmigration was observable around the turn of the century, when profits for the coffee cultivator under the

⁷⁴Schrieke, *Indonesian Sociological Studies*, pp. 96–98; and W. A. C. Whitlau, Governor Sumatra's Westkust, *Memories van Overgave* (henceforth *MvO*) 1926 (typescript), p. 63. Scholz (*Minangkabau*, p. 58) erroneously concludes that the *koffiestelsel* led to an increase in rice production. It is true that rice imports to Padang, which had been a feature of the late 1830s and early 1840s, were no longer necessary by the 1850s. However, the improved rice situation in imports/exports via Padang was actually an artifact of the Dutch rerouting rice exports from the *darek*, which had formerly gone via eastern trade routes, to the west coast as they gained control of the highlands. Cf. Graves, *Minangkabau Response*, pp. 70–71.

⁷⁵Schrieke, *Indonesian Sociological Studies*, pp. 96–98.

⁷⁶K. R. Young, "The Late Nineteenth-Century Commodity Boom in West Sumatra," *Indonesia Circle* 22 (June 1980): 66.

⁷⁷This bias toward export crops continued into the early twentieth century as well. See *De Buitenbezittingen 1904–1914. Mededeelingen van het Bureau voor de Bestuurszaken der Buitenbezittingen* (henceforth *MBB*) 10, 1 (1915). Despite the fact that West Sumatra had been mapped in great detail during the 1883–1896 topographical survey and *sawah* area could have been measured accurately from those maps, there were still complaints about the dearth of statistics on *sawah* and *padi ladang* area. See M. Joustra, *Minangkabau: Overzicht van land, geschiedenis en volk* (The Hague: Nijhoff, 1923), p. 178.

⁷⁸*Ibid.*, p. 732; and *Verslag van den Kamer van Koophandel en Nijverheid te Padang* (henceforth *VKK*), various issues.

⁷⁹Ples, *Koffij-cultuur*, Appendices A and B.

⁸⁰Schrieke, *Indonesian Sociological Studies*, p. 96.

⁸¹Some eastern valleys had land suitable for coffee cultivation but grew little coffee because the nearest government bulking depot was too far away.

⁸²Ples, *Koffij-cultuur*, Appendix B.

koffiestelsel reached a nadir.⁸³ The labor demands of coffee cultivation and outmigration both may have siphoned off labor needed for the maintenance of irrigation systems and *sawah* cultivation.

A more general effect of the *koffiestelsel* on the Minangkabau was the eroding of a society whose social order was based primarily on communally held rice lands.⁸⁴ The export crops promoted by the Dutch were planted on land which was individually owned, not on communally owned clan land. Profits the cultivator received from the sale of coffee, however low, were individually held and not subject to the customary restrictions which applied to most communal property.⁸⁵ This contributed to an individualization of production processes and a partial turning away from communal production activities such as *sawah* cultivation.⁸⁶

Irrigation development during the koffiestelsel. By the 1850s only limited expansion of *sawah* was possible in the *darek*.⁸⁷ One author noted that by this time very few dry-rice fields still existed in most areas of the Padang highlands and almost all rice agriculture was either irrigated or rainfed *sawah*.⁸⁸ Most of the potential irrigation in the *darek* had already been developed.

Irrigation development was more active in the coastal regions during this time. An 1863 government report on rice cultivation in West Sumatra noted that rainfed *sawah* (*sawah tadah hujan*) was increasingly being converted to irrigated *sawah*, and an 1860 report mentioned that in Pariaman and Ulakan north of Padang new canal-building activity peaked that year.⁸⁹ This, however, was a region unsuitable for coffee cultivation and population concentrations in the area were fairly recent phenomena.

In Java, irrigation canals had been constructed under government programs as early as the mid-1700s and large irrigation works were already being developed by the 1830s, first under the direction of the Ministry of the Interior (Binnenlandsch Bestuur) and, beginning in 1854, under the direction of the newly formed Department of Public Works, the Departement der Burgerlijke Openbare Werken (BOW).⁹⁰ Many of the large hy-

⁸³M. Naim, "Merantau: Minangkabau Voluntary Migration" (Ph.D. dissertation, University of Singapore, 1973), p. 122.

⁸⁴Oki, "Social Change," p. 30.

⁸⁵Joel Kahn, "Economic Scale and the Cycle of Petty Commodity Production in West Sumatra," in *Marxist Analyses and Social Anthropology*, ed. M. Bloch (New York: Wiley, 1975), p. 82.

⁸⁶For more detail, see Graves, *Minangkabau Response*.

⁸⁷Couperus, "Aanteekeningen," p. 294.

⁸⁸*Ibid.*, p. 286. See also, G. de Waal, "Aanteekeningen betreffende de rijstkultuur op sawah's in de onderafdeling Limapoeloh Kota der Residentie Padangsche Bovenlanden," *TBG* 30 (1885): 391.

⁸⁹Veth, *Aardrijkskundig en statistisch woordenboek*, p. 731. Unfortunately, no details are given as to what involvement the government may have had in this activity.

⁹⁰In 1935 the BOW changed its name to the Departement van Verkeer en Waterstaat. For histories of irrigation development in Java, see: J. Haringhuizen and A. Nyman, *Irrigation in Netherlands East India*, Netherlands-East-Indian San Francisco Committee, Department of Agriculture, Industry and Commerce, no. 12 (The Hague: van Dorp, 1914); "Bevloeiingen," in *Encyclopaedie van Nederlandsch-Indië*, vol. 1 (The Hague: Nijhoff, 1917), pp. 289 ff.; "Het irrigatiewezen in Nederlandsch-Indië," in *Mededelingen der Regeering omtrent enkele onderwerpen van algemeen belang*, June 1930, pp. 94-118; J. Metzelaar, "Irrigatie," in *De landbouw in den Indischen Archipel*, vol. 1, ed. C. J. van Hall and C. van de Koppel (The Hague: van Hoeve, 1946), pp. 201-38; H. Vlugter, "Honderd jaar irrigatie," *De Ingenieur in Indonesie* 7 (1949): 99-105; and Angoedi, *Sejarah Irigasi*.

draulic works on Java built in the mid-nineteenth century were designed to increase sugar output under the forced cultivation system.⁹¹

In West Sumatra, however, the Dutch made no direct engineering investment in irrigation during the nineteenth century, possibly because of the more limited potential of the region for irrigated export crops. The Government of West Sumatra had no irrigation engineers at its disposal during this time and no plans for irrigation development, other than through exhorting local leaders to extensify irrigated rice area to meet the subsistence needs of the population. All planning, construction, operation, and maintenance of irrigation systems was left in the hands of the farmers themselves.

The Dutch did, however, indirectly influence irrigation at this time by encouraging the timely cleaning of canals and planting of rice in each district. As early as the mid-1800s, they developed planting timetables known as *plakaat sawah*.⁹² The major reason for the *plakaat sawah* appears not to have been as a possible means of regulating water distribution among irrigation systems located along the same rivercourse, but rather to ensure that all arable land was indeed planted, and to minimize pest damage through simultaneous planting. In spite of the *plakaat sawah*, the Dutch blamed poor maintenance of irrigation weirs, high turnover among Dutch supervisory officials,⁹³ and forcing farmers to plant fields which they had little interest in cultivating⁹⁴ as the causes of the rice shortages in the late nineteenth century. These, however, were only proximate causes stemming ultimately from official discrimination against rice in favor of coffee. It was not until the creation in 1905 of the Ministry of Agriculture (Departemen van Landbouw) that a government organ had the specific mandate to attend to improving food crop production and not solely to developing export crops.⁹⁵

1908–1929: Laissez-faire Cultivation Policy

The lifting of the koffiestelsel and increased integration into the world economy. In 1908 the Dutch formally abandoned the *koffiestelsel* and allowed farmers to plant any crops they wished. Crops could be sold at prevailing prices to any private trading concerns. To raise revenues under this new system, a direct taxation system was introduced⁹⁶ which occasioned a minor rebellion in several highland areas in 1908.⁹⁷ Despite the hardship the monetary tax imposed, the privatization of commodities markets and the abolition of forced cultivation and delivery systems did open new economic oppor-

⁹¹Angoedi, *Sejarah Irigasi*, pp. 109, 116.

⁹²The *plakaat sawah* may have been instituted during the term of Resident Steinmetz (1837–1848), but the earliest remaining example dates from September 15, 1863 for 1863/64 for the Padang Highlands. See W. Frijling, "Bestuurscontrole op de inlandsche rijstcultuur ter Sumatra's Westkust," *Tijdschrift voor het Binnenlandsch Bestuur* (henceforth *TBB*) 52 (1917): 95–97.

⁹³"Rijtschaarsche en koffiecultuur in de Padangsche Bovenlanden," *IG* 26, 2 (1904): 1898.

⁹⁴C. Lulofs, "Naschrift van de redactie," *TBB* 51 (1917): 77.

⁹⁵Angoedi, *Sejarah Irigasi*, p. 108.

⁹⁶The taxes were a 2 percent income tax on adult men, plus a slaughter tax. Corvée labor was also still required for public works projects. Later, in 1915, under the Nagari Ordinance, customary dues collected by the *nagari*, such as occasional labor service (*sarayo*) or occasional money contributions (*iuran urang*), were de facto converted into regular government taxes. See Akira Oki, "Economic Constraints, Social Change, and the Communist Uprising in West Sumatra (1926–1927)," in *Change and Continuity in Minangkabau*, ed. Thomas and von Benda-Beckmann, pp. 213, 220.

⁹⁷DPK, *Sejarah Sumatera Barat*, pp. 84–86.

tunities. The Minangkabau responded to higher profits from coffee and to new crops such as rubber and cloves.

Rice production also rebounded after the ban on rice exports from West Sumatra was rescinded in 1912.⁹⁸ In his inaugural address, Governor Ballot stressed that three things were important in rice cultivation: (1) the timely planting in accordance with the onset of the monsoon; (2) the drying out of the fields during the dry season; and (3) non-interference with the farmers' choices in the marketing of the crop.⁹⁹ West Sumatra again became a net exporter of rice,¹⁰⁰ although the Dutch themselves disagreed as to whether this was primarily due to the lifting of restrictions on the rice trade or to a reinforcement of the *plakaat sawah* regulations.¹⁰¹ Food crop production was also supported by the establishment in 1916 of the Agricultural Extension Service (*Landbouwwoorlichtingsdienst*).¹⁰² Table 2 shows the status of rice imports and exports via Padang during the period 1909–1928.

Table 2. Annual Milled Rice Exports and Imports, Padang, 1909–1928
(Based on five-year average)

Year	Exports (000 tons)	Imports (000 tons)	Net Flow (000 tons)
1909–1913	3600	211	+3389
1914–1918	8965	5484	+3481
1919–1923	2866	3729	-863
1924–1928	3238	2295	+943

Source: VKK, various issues.

During the 1920s, rice exports roughly balanced imports, production keeping pace with population growth. However, we must not overestimate production in West Sumatra, for up to half of the rice exports from Padang after 1922 originated from the Kerinci area, which was directly subsumed under the administration of West Sumatra after the completion of the connecting road to Padang in 1921.¹⁰³ Taking this into

⁹⁸Statistics anomalously show some rice export during 1910 and 1911 before the lifting of the ban. See VKK (1925), Appendix 2.

⁹⁹In Joustra, *Minangkabau*, p. 180.

¹⁰⁰VKK (1925), Appendix 2; and M. B. Smits, "Nog eens de rijstproductie ter Sumatra's Westkust," *TBB* 51 (1917): 514–15.

¹⁰¹See, W. Steinbuch, "Bestuurscontrole op de inlandsche rijstcultuur ter Sumatra's Westkust," *TBB* 51 (1917): 67–74; and Smits, "Nog eens de rijstproductie," pp. 513–14. Frijling, "Bestuurscontrole," p. 97, claimed that the *plakaat sawah* never really fell into disuse. Nevertheless, it is apparent from Steinbuch's account that there was a tension between the Dutch administration and the farmers, who wanted to plant according to their own schedule—often so that harvest would coincide with the fasting month and the *zakat* (religious tax) could thus more easily be paid (Smits, "Nog eens de rijstproductie," p. 514). Another account says that government enforcement of the *plakaat sawah* was making farmers plant fields against their will and was causing bad harvests. See Lulofs, *Naschrift van de redactie*, p. 77.

¹⁰²Joustra, *Minangkabau*, p. 79.

¹⁰³Oki, "Social Change," pp. 43–46, 161. Kerinci was under the indirect administration of the governor of West Sumatra from the time of its military occupation by the Dutch in 1903 until 1922, when it formally became part of West Sumatra.

account, the area of present-day West Sumatra appears to have been a net importer of rice, as farmers took advantage of the high prices for cash crops during the 1920s.

The large expansion of the copra industry in Pariaman in the 1880s and 1890s, the rise of tobacco and gambir as commercial crops in the *darek*, the introduction of *Robusta* coffee in the highlands in 1915, and the rapid spread of rubber in 1920, especially in outlying districts,¹⁰⁴ not only increased production for the market, but also heightened the vulnerability of the Minangkabau farmer to the vagaries of world prices. This was especially true in the minor depression during the First World War and in the recession immediately following.¹⁰⁵ Such was the state of monetization of the economy that in Alahan Panjang, one of the poorest and least monetized rural areas in West Sumatra, the proportion of cash income to total income in 1926 was over 66 percent.¹⁰⁶ However, because cash cropping had already been practiced for some time, the increased monetization of the economy after 1912 may not have been the watershed Schrieke believed, but rather only an intensification of patterns already begun decades earlier.¹⁰⁷

Rice versus other agricultural commodities. Rice agriculture had to compete for labor with coffee and other export crops. In 1927, coffee was again the most important export from Padang,¹⁰⁸ and again, highland fields were turned over to export crops, often at the expense of pasture land needed for draft animals used in *sawah* cultivation.¹⁰⁹

High prices for export crops during the 1920s encouraged farmers in outlying areas to switch from dry rice to cash crops. This was most pronounced in Indrapura and Tapan in southern Pesisir Selatan, in the Muara Labuh valley, and in Lubuk Sikaping.¹¹⁰ The slope and good drainage of most dry-rice fields made them highly suitable for the cash crops popular during this period. The heavy clay soils of many of the ancient *sawah* lands were ill-suited for these commercial crops and remained under *sawah* cultivation. During this time, only a moderate expansion of *sawah* took place, again mostly in coastal areas.¹¹¹

Akira Oki makes an important point about the 1920s in West Sumatra with his observation that outlying areas were able to concentrate on cash-crop production precisely because the *darek* was able to produce a rice surplus.¹¹² Rice production in the *darek* was spurred by higher prices, and marketing was facilitated by Dutch programs to expand and improve the road network. West Sumatra was developing a regional division of crop specialization in which the *darek* and outlying areas were joined in tighter economic interdependence.

¹⁰⁴See Young, "Late Nineteenth-Century Commodity Boom," pp. 65–67; and M. B. Smits, *Over den landbouw in Nederlands-Indië* (Groningen: Wolters, 1929), p. 142.

¹⁰⁵Kamar, in Oki, "Economic Constraints," p. 223.

¹⁰⁶Schrieke, in *ibid.*, p. 216.

¹⁰⁷Schrieke, *Indonesian Sociological Studies*, pp. 99 ff. Other sources also show there was a movement from a subsistence economy to a monetized economy at least two decades before the lifting of the *koffiestelsel* in 1908. See Oki, "Economic Constraints"; Kahn "Commercialization and Change"; and Young "Late Nineteenth-Century Commodity Boom."

¹⁰⁸Huitema, *De bevolkingskoffiecultuur*, p. 63.

¹⁰⁹*Verslag van den economischen toestand der inlandsche bevolking, 1924*, vol. 2 (Weltevreden: Landsdrukkerij, 1926), p. 197.

¹¹⁰Schrieke, *Indonesian Sociological Studies*, pp. 101–4.

¹¹¹In 1908–1909 an estimated 1300 ha of new *sawah* were created in the Pariaman and Kayu Tanam districts near the coast (Joustra, *Minangkabau*, p. 178). Modest expansion of *sawah* was also later reported in Pariaman and Painan. See *Jaarsverslag van den Landbouwvoorlichtingsdienst 1919*, p. 300.

¹¹²Oki, "Social Change," pp. 62–64. Again, the surpluses from Kerinci played a key role here.

Irrigation development (1908–1929). The power of the *pangulu* and other traditional elites was primarily based on *sawah*, not dry cropland. This power base was again diluted during the 1920s by the increasing importance of cash cropping on non-*sawah* lands.¹¹³ However, during this time the *pangulu* did begin to benefit from Dutch interest in actively improving *sawah* through measures such as irrigation development.

With the collection in 1907 of data on existing irrigation works, improvements considered necessary, and possibilities for extensions or new works, the Dutch for the first time began to pay specific attention to irrigation outside Java and Madura. This report, however, was considered unsatisfactory, and from 1910 to 1912 engineers conducted inquiries into irrigation on Sumatra and Sulawesi. The reports in 1914 of Ir. van Tubergen for Sumatra and Ir. van Buuren for Sulawesi led to the appointment of eight engineers outside Java to plan and execute simple irrigation and drainage works.¹¹⁴ One of these engineers, J. van Tubergen, was assigned to West Sumatra,¹¹⁵ and the budget proposed for the irrigation service in West Sumatra ranked highest of all the Dutch territories in Sumatra.¹¹⁶

The van Tubergen report was instrumental in charting the course of government irrigation development plans in Sumatra. According to the report, the first priority was the construction of new works for opening up new land and for converting rainfed lands into irrigated lands.¹¹⁷ In West Sumatra, because much of the potential irrigable land was already being irrigated, development of new irrigation works would be largely confined to outlying areas, such as Pasaman.¹¹⁸

Of secondary importance, according to the report, was the rehabilitation and improvement of existing works. Regarding this, the report reached several important conclusions:

(1) Improvements in existing systems will have more effect on lessening the labor burden for system maintenance and on reducing interruptions in water flow, rather than on increasing rice production itself.

(2) It will be difficult to levy irrigation fees on the farmers in government-assisted systems because it will be difficult to show improvement in rice yields. More efficient methods of water management, however, should be introduced.

(3) The improvement of existing systems should be executed with *corvée* or communal labor, with cash payments borne as much as possible by those who benefit.

(4) The improvement of existing systems should take care not to disadvantage other existing downstream systems.

¹¹³Ibid., p. 131.

¹¹⁴*De Buitenbezittingen, 1904–1914*, p. 58.

¹¹⁵Haringhuizen and Nyman, *Irrigation in Netherlands East India*, p. 71. The other engineers were placed in Aceh, Bengkulu, Palembang, Bali, Sulawesi, and Manado. In West Sumatra the irrigation service initially had its own engineer. By the 1920s, however, it was taken over by the BOW, the department of public works. See Whitlau, *MvO*, 1926, p. 89.

¹¹⁶J. van Tubergen, "Verslag nopens een ingesteld irrigatie-onderzoek op Sumatra," in *Verslag over de burgerlijke openbare werken in Nedelandsch-Indië over het jaar 1916*, Pt. 5: Irrigatie, waterafvoer en waterkeering, App. I (Batavia: Papyrus, 1916), p. 172.

¹¹⁷Ibid., p. 10.

¹¹⁸Ibid., pp. 146–51.

(5) The operations and maintenance of small irrigation systems should be left in the hands of the farmers.

(6) The Dutch government should play a role in the coordination of water allocation and distribution among systems located along common rivercourses.

(7) Any intervention in existing works must be done with the utmost circumspection and consideration of the consequences. Pre-intervention preparation must include drawing good irrigation maps, including the main canals and the command areas for each canal.¹¹⁹

Thus, the report was clearly aware that small-scale irrigation systems were extensive, quite efficient at producing good rice yields, and should only be improved after careful consideration of the consequences. Farmers were to be involved in the rehabilitation of such works. While mobilization of *corvée* labor, for instance, cannot be considered a participatory approach, it is clear that the Dutch were attempting to elicit a contribution from the farmers in terms of labor, money, and materials. The reason behind this was to minimize government expenditure, but it was also consistent with current theories about the importance of contributions from farmers for the development of property rights and for encouraging the sense of ownership necessary for continued maintenance. The Dutch were not pursuing a direct investment policy which emphasized state planning and execution of small irrigation works without any farmer involvement.

After publication of the report, officials and businessmen who had for some years remarked on the necessity of improving irrigation works in the province, were initially enthusiastic about the measures proposed there for increasing rice output.¹²⁰ However, compared to Java there was in West Sumatra at the time little *corvée* labor available for village roads, canals, and other public works, and most Dutch-organized labor was spent on road construction and repair, not on irrigation.¹²¹

As the van Tubergen report had predicted, the irrigation work the Dutch began outside Java in these early years was "of minor importance,"¹²² and consisted primarily of improving existing village irrigation *wiers* (*bevolkingstuwdammen*) rather than constructing new ones.¹²³ While the government made some funds available for these improvements, the projects were "... executed with the aid—as far as possible—of 'compulsory labour.'"¹²⁴

Farmers in Indonesia were not assessed directly for any improvements in irrigation systems.¹²⁵ While farmers in Java had to pay indirectly for these improvements because the land tax was based on yields,¹²⁶ those in West Sumatra paid nothing because there was essentially no land tax.¹²⁷ In 1922 the Dutch tried to institute a land tax, but opposi-

¹¹⁹*Ibid.*, pp. 10–14, 43, 139, 144–45.

¹²⁰VKK (1920): 10–11.

¹²¹F. van Ginkel, "De economische toestand en de belastingdruk met betrekking tot de inlandsche bevolking van Sumatra's Westkust," *Rapport van de Commissie van Onderzoek*, vol. 2 (Weltevreden: Landsdrukkerij, 1928), p. 126.

¹²²Haringhuizen and Nyman, *Irrigation in Netherlands East India*, p. 71.

¹²³See VKK (1910–1916).

¹²⁴Haringhuizen and Nyman, *Irrigation in Netherlands East India*, p. 71.

¹²⁵Cf. M. B. Smits, *Over den landbouw*, pp. 63–64.

¹²⁶For Java, see J. Klaveren, *The Dutch Colonial System in the East Indies* (Rotterdam: Benedictus, 1953), pp. 172–73.

¹²⁷In fact, there was a small ground tax (*verponding*), but realization of revenues from this source were negligible. See van Ginkel, "Economische toestand," p. 24. One source mentions that "rubber money"—funds

tion was so strong that implementation of the tax was delayed and, in 1923, abandoned.¹²⁸

In general, the Irrigation Service of the Dutch government, the Dienst Irrigatie, had three tasks at this time: (1) ". . . the planning and execution of new irrigation works, including technical management and water division in those irrigated areas; (2) the improvement of existing indigenous works and the assumption of regular management in those works; and (3) the provision of information and assistance for the construction or improvement of very small works."¹²⁹ In West Sumatra the Dutch were primarily concerned with the larger of the irrigation projects they undertook,¹³⁰ and they assumed main system management of some of the larger of the previously farmer-managed systems,¹³¹ allowing the farmers to manage water at the tertiary level. In very small systems the Dienst Irrigatie placed no personnel at all, leaving the systems entirely in the hands of the farmers after the construction or rehabilitation of the irrigation works was completed. In general, for the areas outside Java and Madura, the government saw greater potential for building "scientifically constructed" small irrigation works rather than developing large irrigation facilities.¹³²

Dutch observers felt there was a general lack of formal water users' associations in West Sumatra, especially as compared to Bali.¹³³ One study recommended the formation of "interest groups for irrigation purposes" ("*belangengemeenschappen voor bevoeiingsdoeleinden*"),¹³⁴ and early in the period of direct government irrigation assistance there was some talk of forming water-users' associations (*waterschappen*) in the Padang environs and in Agam.¹³⁵ However, this apparently was not pursued, except possibly for the strengthening of a traditional irrigation leader called the *tuo banda*. In any case, despite their lack of formal irrigation associations, Minangkabau farmers were noted for being good irrigators and rice cultivators.¹³⁶

In general, however, the Dutch appeared to be half-hearted in developing both the physical and social infrastructure for irrigation in West Sumatra. Indeed, the delay in executing long-planned irrigation works was one of the criticisms Schrieke made in his 1927 report on the social and economic bases of Communist activity in West Sumatra.¹³⁷

somehow collected through the taxation or marketing of rubber—were used to finance some small irrigation improvements designed by the government. Unfortunately, this financing system is not explained. See VKK (1938): 72.

¹²⁸ Abdullah, "Modernization in the Minangkabau World," pp. 148 ff.; Oki, "Social Change," p. 92.

¹²⁹ Smits, "Over den landbouw," p. 63.

¹³⁰ "Dari Hal Pengairan," SCPT 11, 9 (March 1938): 103.

¹³¹ For example, Bdr. Kuranji (Bdr. Gunung Nago) near Padang; Bdr. Lampasi in Limapuluh Kota; and Bdr. Galo Gandang in Tanah Datar. See Asnawi et al., *Sebuah studi perbandingan tentang sistem-sistem manajemen irigasi untuk padi sawah di Sumatera Barat* (Padang: Universitas Andalas, 1984), pp. 104–5, 146–47; and R. J. S. Schäfer (Controleur, Fort van der Capellen), *MvO*, 1935, Appendix X.

¹³² "Het irrigatiewezen in Nederlandsch-Indië," p. 118.

¹³³ For example, see C. D. Willinck, *Het rechtsleven bij de Minangkabausche Maleiërs* (Leiden: Brill, 1909), p. 684.

¹³⁴ Van Ginkel, "Economische toestand," p. 126.

¹³⁵ See VKK (1914): 27.

¹³⁶ See, for example, M. B. Smits, "Enkele bijzonderheden van de rijstkultuur ter Sumatra's Westkust," *Teysmannia* 26 (1916): 625.

¹³⁷ B. Schrieke, *Rapport van de Commissie van Onderzoek*, vol. I, Section 2 (Weltevreden: Landsdrukkerij, 1928), p. 157. It is also interesting to note that the irrigation section in *Verslag van de Kamer van Koophandel en Nijverheid te Padang* disappears after 1916 and resurfaces only in 1935, possibly also an indication of the relative unimportance of government irrigation projects during this time.

In 1928 an irrigation committee was set up for West Sumatra which included "Agriculture Council staff," "irrigation specialists," and Minangkabau district and sub-district heads, but for lack of funds the committee never followed through with any comprehensive irrigation planning.¹³⁸

The World Economic Depression (1929–1942): Return to Rice

Fall in commodity prices. The world economic depression begun in 1929 rapidly spread to the Netherlands Indies, and plummeting commodity prices soon sparked a retrenchment to subsistence-oriented agriculture throughout the archipelago. West Sumatra, too, experienced drastic declines in the prices of cash crops. For example, the price of coffee in 1936 was only 15 percent of its 1929 price; copra in 1938 was only 6 percent of its 1929 price; and rubber in 1933 had fallen to only 8 percent of its 1929 price.¹³⁹

Rice prices also fell sharply, although not as drastically as those of export crops. By 1933, the price had fallen to f3.75 per *picol* (62.5 kg), less than one-third the f12 per *picol* price before the onset of the depression. Prices stayed very low throughout the mid-1930s and only began edging upward in 1937.¹⁴⁰ During the depression, local trade declined most in the areas where cash cropping had been strongest, although it fared somewhat better in the rice centers.¹⁴¹

Rice production. The increase in rice production before the depression had been primarily a rebound from the unfavorable conditions for rice cultivation during the *koffie-stelsel*, and did not represent any real advances in rice production technology. During the depression, low rice prices had a particularly dampening effect on rice production. This can be seen in rice trade figures for the period 1929–1938 in Table 3.

Table 3. Rice Exports and Imports, West Sumatra, 1929–1938

Period	Yearly Average (metric tons)		
	Exports	Imports	Net Flow
1929–1932	984	3261	-2277
1934–1935	68	2744	-2676
1936–1938	226	6013	-5787

Source: VKK, various issues.

By the mid-1930s, yearly paddy production in West Sumatra was only averaging 350,000 tons, not much higher than estimated production for the region back in the

¹³⁸Oki, "Social Change," p. 163.

¹³⁹VKK, various issues.

¹⁴⁰Ibid.

¹⁴¹Oki, "Social Change," p. 142.

1850s, in spite of some limited increases in *sawah* area.¹⁴² The poor showing in production figures, however, may be a combination of the stored reserves from Kerinci which had come on to the market in the 1920s being exhausted, and reduced marketing of rice due both to low prices and the need to feed a population swollen by residents returning to the villages as their business ventures in urban areas floundered. Finally, in the late 1930s and early 1940s rice prices rose and the harvest increased to approximately 500,000 tons of paddy. Even with the better harvests, however, West Sumatra remained a minor rice importer.

Irrigation development (1929–1942). With the collapse of the export economy in the 1930s, the subsistence-oriented shift in the economy favored *sawah* over other crops.¹⁴³ Traditional leaders began using slogans such as “back to rice” in areas formerly heavily involved with export crops. *Sawah* was worked more intensively during the 1930s than it had been during the 1920s, and cases of land pawning, such as Schrieke had decried, declined as the role of *sawah* assumed greater economic importance.¹⁴⁴

This renewed reliance on *sawah* provided an incentive to invest further in irrigation. However, such new investment had to come mostly from the village, as the Dutch government had little money to spend on irrigation during the 1930s, with revenues cut sharply by the decline in the export prices of agricultural commodities.¹⁴⁵ For example, in 1935 the government of West Sumatra requested 150,000 guilders for irrigation projects in the province but was only allocated 5,000 guilders.¹⁴⁶ Compared to Java, Dutch expenditures on irrigation in other areas were small.¹⁴⁷

What Dutch assistance did come was still predominantly directed toward small-scale works and a few medium-scale irrigation works, although Dutch engineers began providing technical assistance to those *nagari* that requested help with designing irrigation rehabilitation or construction. The responsibility for the costs of all labor and materials in such projects, however, rested with the *nagari* itself.¹⁴⁸

Most of the larger irrigation works which the Dutch did build on Sumatra during the 1930s were not located in West Sumatra.¹⁴⁹ These works, which were predominantly new systems constructed for Javanese transmigrants in Lampung, Bengkulu, and South

¹⁴²Average yearly production of paddy for the period 1853–1863 was about 315,000 tons of paddy. See Veth, *Aardrijkskundig en statistisch woordenboek*, p. 732; and VKK, various issues. Unless noted otherwise, all figures in this study represent only the present-day territory of West Sumatra.

¹⁴³See, for example, Mohamad Said, “Irikasi atau Pengairan di Onderafdeeling Fort van der Capellen,” *Tani* 5, 10 (April 1932): 110.

¹⁴⁴Schrieke, *Indonesian Sociological Studies*, pp. 115–16; and Oki, “Social Change,” p. 129.

¹⁴⁵B. H. F. van Heuven (Resident, Sumatra’s Westkust), *MvO*, 1934, pp. 175–76, 199–200. Said, “Irikasi,” p. 110. Oki (“Social Change,” p. 160) shows that government revenues from taxes in West Sumatra in 1935 were only 40 percent of their 1929 level.

¹⁴⁶A. I. Spits (Resident, Sumatra’s Westkust), *MvO*, 1938, pp. 102–3.

¹⁴⁷Van der Meulen in A. Booth, “Irrigation in Indonesia, Part 1,” *Bulletin of Indonesian Economic Studies* (henceforth *BIES*) 13, 1 (1977): 37–38.

¹⁴⁸Van Heuven, *MvO*, pp. 200–202; and C. F. Gonggrijp (Resident, Sumatra’s Westkust), *MvO*, 1931, pp. 112–13.

¹⁴⁹Examples of Dutch involvement in irrigation in Sumatra can be found in Aceh (“Irrigatie in Atjeh,” *Deli Courant* [henceforth *DC*], April 29, 1930, and “Op reis door Atjeh,” *DC*, October 28, 1932); in North Sumatra (“De Irrigatiewerken in Simeloengoen,” *DC*, January 28, 1935, and M. J. Rotteveel, “Het irrigatievraagstuk ter Oostkust van Sumatra,” *De Waterstaats-Ingenieur*, 8, 6 [1920]: 256–60); in South Sumatra (F. Garot, “Onderzoek naar den gunstigsten vorm eener vrije aftapping, ontworpen in de Aër Klingi op Sumatra,” *De Ingenieur in Nederlandsch-Indië* 4, 5 [May 1937]: 79–88); and in Lampung (“Weekrevue,” *Algemeen Landbouweekblad voor Nederlandsch-Indië* 16 [October 1931]: 458).

Sumatra, often consumed more than half of the total budget for irrigation development outside Java.¹⁵⁰ The Dutch made only very limited efforts to move Javanese farmers to West Sumatra, however, and no large irrigation systems for transmigrants were completed there.¹⁵¹

As trustees of communal *sawah*, the position of village elites, the *pangulu*, was enhanced by the population's increased reliance on *sawah*. At the local level, the *pangulu* took the lead in galvanizing irrigation improvements during the depression, sometimes even using their personal funds.¹⁵² The *pangulu* took care of seeing to the needs of all the *nagari* inhabitants, both long-standing residents and those returning from failed ventures elsewhere. These activities enhanced the prestige of the *pangulu*, who had been under assault by the Communists and "modernizers" (*kaum muda*) during the export boom years of the 1920s.¹⁵³ The phrase "retain the *adat* and you will not go hungry" supported this relegitimization of the role of the *pangulu* in the *nagari*.¹⁵⁴

During this time there may have also been a re-emergence of "traditional" irrigation leaders, usually called *tuo banda*, although there is insufficient evidence to say whether the term predates Dutch times or was created or popularized by the Dutch themselves.¹⁵⁵ Some documents imply that in selected areas, especially around Solok, *tuo banda* were installed on the initiative of the Dutch in an attempt to improve maintenance of irrigation systems and to better coordinate the *plakaat sawah*.¹⁵⁶ Dutch concern about the viability of the institution of the *tuo banda* was another indication of the renewed importance of *sawah* during the depression years.

1943–1950: The Japanese Interregnum and the Struggle for Independence

Rice production. During the Japanese occupation of West Sumatra from 1942 to 1945 rice production fell sharply, due to a combination of lack of male labor and, beginning in 1944, forced procurement of up to 50 percent of the rice harvest for the Japanese armed

¹⁵⁰Some examples in Sumatra of irrigation systems for transmigrants from Java are Way Sekampong (20,000 ha) and Sukadana (33,400 ha) in Lampung; Perbo (3,500 ha) in Bengkulu; and Aer Komering (12,500 ha) and Lubuk Linggau (3,000 ha) in South Sumatra. See the "Waterstaat," in the yearly issues of *Indisch Verslag, Tekst van het verslag van bestuur en staat van Nederlandsch-Indië over het jaar* (1930–1938) (The Hague: Algemeene Landsdrukkerij, yearly, 1931 to 1939).

¹⁵¹Two irrigation projects in West Sumatra for transmigrants were: (1) an investigation for a new system in Indrapura, near Bengkulu (see VKK [1935]: 82); and (2) a planned extension of the Muara Mais canal in Desa Baru, Pasaman, to irrigate about 1,500 ha. Although families arrived in early 1940, the outbreak of World War II forestalled the project. See T. Krimmel et al., "Pre-Feasibility Study for the Bt. Batahan Irrigation System," Area Development Project West Pasaman (henceforth ADP), no. 12 (Padang and Eschborn: Bappeda and German Agency for Technical Cooperation, 1986).

¹⁵²Oki, "Social Change," pp. 163–64.

¹⁵³Taufik Abdullah, *Schools and Politics: The Kaum Muda Movement in West Sumatra (1927–1933)* (Ithaca, N.Y.: Cornell Modern Indonesia Project, 1971).

¹⁵⁴Oki, "Social Change," p. 174.

¹⁵⁵I have found no reference to the *tuo banda* before the late 1920s. This is curious as the Dutch were keen ethnographers of the Minangkabau. Either no one examined traditional irrigation systems in detail before the 1920s, or the title *tuo banda* was created by the Dutch.

¹⁵⁶Isrin, "Sedikit tentang dihidopkan kembali 'Toeo Banda' dibagian Solok," *SCPT* 7, 12 (1934): 139; VKK (1935): 82; van Heuven, *MvO*, p. 178.

forces.¹⁵⁷ During the Japanese interregnum irrigation systems received little attention, the *plakaat sawah* was not followed, and the fields were not well tended.¹⁵⁸

Similarly, during the struggle for independence against the Dutch (1945–1949), labor was often not available in the right places at the right time to produce good crops. Interviews with village leaders in several parts of the province indicate that many irrigation systems were not maintained after the men fled to the hills to fight the guerrilla war.¹⁵⁹ Much of the burden of rice cultivation was borne by the Minangkabau women, and there was little incentive or opportunity to produce rice above subsistence levels. West Sumatra continued to require rice imports during the 1940s.¹⁶⁰

1950–1985: The Post-Colonial Years

Expansion of sawah area. The years since independence have been marked by a slow expansion of irrigated area and a large increase in rice production in West Sumatra. Some of this expansion of irrigated area has been achieved through the development of new lands, but most of it has been the result of: (a) improvements in irrigation facilities enabling rainfed *sawah* (*sawah tadah hujan* or *sawah banda langik*) to become irrigated *sawah*; and (b) the increase in the cropping index from better water provision and short maturing seed varieties. Table 4 shows the development of rice area and the cropping index in West Sumatra.

Based on these figures, the expansion in terms of land area committed to *sawah* during the last seventy years has been only about 40,000 to 50,000 ha. As pointed out earlier, the expansion that did take place occurred primarily in fringe areas. Figures from 1969 indicate that almost all land suitable for new *sawah* was located at the very borders of West Sumatra. Tanah Datar in the heartland, for example, showed no possibility of *sawah* expansion.¹⁶¹

There is less information on the proportion of irrigated to rainfed *sawah* during this period. One estimate from the mid-1920s places irrigated *sawah* in West Sumatra at about 137,000 ha with an additional 60,000 ha rainfed *sawah*.¹⁶² In 1986, the area of irrigated *sawah* was listed as 158,000 ha and that of rainfed *sawah* as 62,000 ha.¹⁶³ Thus, during the last sixty years there appears to have been no change in the amount of rainfed *sawah* but an increase of about 21,000 ha in irrigated *sawah*. This has occurred through the conversion of rainfed *sawah* into irrigated *sawah*, especially at the initiative of the Dutch and Indonesian governments, and an equal expansion of new rainfed *sawah* in remote areas of the province.

¹⁵⁷Kementerian Penerangan, *Propinsi Sumatera Tengah*, p. 651; DPK, *Sejarah Minangkabau*, p. 210; and Oki, "Social Change," p. 235.

¹⁵⁸Kementerian Penerangan, *Propinsi Sumatera Tengah*, pp. 651–52.

¹⁵⁹An example from Pasaman can be found in John Ambler, "Consultant's Report on the Socio-Economic Organization of Irrigation in the Batang Kenaikan I Project Area," ADP no. 9 (Padang and Eschborn: Bappeda of West Sumatra and German Agency for Technical Cooperation, 1985), p. 19.

¹⁶⁰Kementerian Penerangan, *Propinsi Sumatera Tengah*, p. 651.

¹⁶¹SBDA (1970), p. 58.

¹⁶²Smits, *Over den landbouw*, p. 142. The area of *sawah* in Kerinci has been subtracted from Smits' estimate of 150,000 ha for West Sumatra. I have estimated 13,000 ha of irrigated *sawah* and 3,000 ha of rainfed *sawah* in Kerinci at that time.

¹⁶³SBDA (1987), p. 196.

Table 4. Area of *Sawah*, All Types, West Sumatra, 1918–1985 ('000 ha)

Year	Total <i>Sawah</i> (irrigated and unirrigated)	Harvested Area	Cropping Index
1918	160	160	1.0 (est.)
1934	197	197	1.0 (est.)
1954	170	170	1.0 (est.)
1970	227	247	1.09
1975	209	263	1.26
1979	210	281	1.34
1985	222	329	1.48

Sources: 1919: Departement van Landbouw, Nijverheid en Handel, *Jaarsverslag van den Landbouw-voorlichtingsdienst* (henceforth JL), 1918 (Buitenzorg: Archipel Drukkerij, 1919), p. 252; 1934: B. H. F. van Heuven, "Memories van Overgave," 1934, p. 174; 1954: Kementerian Penerangan, *Republik Indonesia Propinsi Sumatera Tengah* (Jakarta, 1954), p. 651; 1970: Direktorat Tata Guna Tanah, "Propinsi Sumatera Barat, luas penggunaan tanah kecamatan, 1977," Publikasi No. 91, Jakarta; 1975–85: *Sumatera Barat Dalam Angka*, various issues.

Notes: The figure for 1918 may be an underestimate of "normal" area because 1918 was an exceptionally dry rainy season and only irrigated *sawah* could be planted at the usual time; much rainfed *sawah* was not planted at all (JL, 1918, p. 251). The 1934 figure listed in van Heuven is 213,000 ha, but that includes Kerinci which was part of West Sumatra from 1922 to 1957. From this figure I have subtracted 16,000 ha, the area of *sawah* in Kerinci as measured from the 1915 map "Schetskaart van de Afdeeling Koerintji van de Residentie Djambi, Schaal 1:200,000." This map is contained in Aken, *Mededeelingen van het Bureau voor de Bestuurszaken der Buitenbezittingen, bewerkt door het Encyclopaedisch Bureau*, Aflevering VIII (Batavia: Papyrus, 1915), Appendix I. The figure for 1954 has been adjusted in a like manner.

Irrigation development. By 1954, government programs had improved irrigation facilities for only about 15,000 ha of *sawah*.¹⁶⁴ Although the provincial government gave some minor assistance to small-scale irrigation in the form of materials in the mid-1950s,¹⁶⁵ political turmoil and economic instability prevented any significant rehabilitation of irrigation in West Sumatra from 1950 until 1966. In fact, during that time the irrigated area of systems under government management actually decreased from 45,000 ha to 29,000 ha.¹⁶⁶ This problem beset not only West Sumatra, but all Indonesia, as pre-1965 governments neglected to maintain irrigation systems.¹⁶⁷

The spread of the HYVs. As a major importer of rice, Indonesia was quick to adopt modern seed varieties (HYVs) in the mid-1960s, when they first became available. Before the advent of this green revolution, all *sawah* in West Sumatra was only single cropped to rice, and usually no unirrigated crop was grown in the *sawah*. Yet by 1985, the cropping index for all *sawah* had risen to 1.48. That is, on average, each piece of *sawah* land was being harvested nearly one and one-half times per year. Assuming that rainfed

¹⁶⁴Kementerian Penerangan, *Propinsi Sumatera Tengah*, p. 653.

¹⁶⁵Hamzal Gafar, "Community, Bureaucracy, and Hydraulic Networks," Project Report, Cornell University, 1987, p. 131.

¹⁶⁶S. Asnawi and R. T. Shand, "The Economic Impact of Irrigation in West Sumatra, Indonesia," in *Irrigation Management: Research from Southeast Asia*, ed. T. Wickham (Bangkok: Agricultural Development Council, 1985), pp. 109–10.

¹⁶⁷Booth, "Irrigation in Indonesia, Part 1," p. 51.

sawah is still only single cropped,¹⁶⁸ then the cropping index for rice for irrigated *sawah* alone had reached 1.67 by 1985. Planting a second non-rice crop on *sawah* is still not common in West Sumatra.¹⁶⁹

This important increase in cropping intensity has been made possible in part because irrigation water is available for modern seed varieties. The long history of irrigation development in West Sumatra and its abundant water resources have enabled single-cropped irrigated land to move to double-cropped irrigated land with little change in the physical structures of many irrigation systems. Furthermore, in formerly rainfed coastal areas the new seeds have provided an increased incentive to developing new canal systems for irrigated *sawah*.

But the success of the HYVs in West Sumatra also owes much to a good match between a new technology and a local culture which had reached technological rather than social limits to increased production. By the mid-1960s very little expansion of *sawah* was possible in West Sumatra, and, with the varieties the Minangkabau farmer possessed at the time, little could be done to improve yields. First the Dutch¹⁷⁰ and later the Japanese,¹⁷¹ had found difficulty in surpassing the rice cultivation techniques the Minangkabau were already using. What was needed to increase production were not incremental adjustments to existing techniques, but radically new technologies. The HYVs, first developed in the mid-1960s at the International Rice Research Institute in Los Baños in the Philippines, provided those technologies.¹⁷²

The spread of the HYVs in West Sumatra proceeded rapidly under government programs aimed at disseminating the seeds, fertilizers, credit, and cultivation information needed to take advantage of the genetic potential of the new stock.¹⁷³

Table 5 shows the coverage of the programs disseminating HYV technology in West Sumatra.

¹⁶⁸The 1971/72 land use survey in West Sumatra indicated that rainfed *sawah* was harvested only once a year. See K. H. Junghans, *Introduction to the Land Use Survey in Sumatera Barat*, and *Land Use in Sumatera Barat*, 8 vols., West Sumatra Regional Planning Project (Bonn: Institut für Agrarpolitik, Marktforschung und Wirtschaftsoziologie, Bonn University, 1972).

¹⁶⁹For example, in 1971/1972 total *sawah* area was 216,245 ha, while the total area of non-rice crops planted in *sawah* was only 18,576 ha. (Calculated from West Sumatra Regional Planning Project, *ibid.*) Recent drops in the price of rice relative to the prices of other crops may now encourage some shifts to non-rice crops during the second rice season.

¹⁷⁰See, for example, M. B. Smits, "Enkele bijzonderheden," p. 625.

¹⁷¹Oki, "Social Change," pp. 234-35.

¹⁷²For a discussion of the changes in cultivation techniques with HYVs, see John Ambler, "Management of Small-scale Irrigation in West Sumatra, Indonesia: Farmer-managed and Government-assisted Systems in a Changing Institutional and Technological Environment" (Ph.D. dissertation, Cornell University, 1988).

¹⁷³These programs had different names, each with a slightly different combination of input, credit, and marketing arrangements. In chronological order, the major rice intensification programs in West Sumatra were called: BIMAS, BIMAS Gotong Royong (BIMAS AHT), BIMAS yang disempurnakan, BIMAS Baru, INMAS, INMAS Baru, INSUS, INMUM. For descriptions of the early national BIMAS program see, for example, E. A. Roekasah and D. Penny, "BIMAS: A New Approach to Agricultural Extension in Indonesia," *BIES* 7 (June 1967): 60-69; L. Mears and S. Afiff, "A New Look at the BIMAS Program and Rice Production," *BIES* 10 (1968): 29-47; and G. Hansen, "Episodes in Rural Modernization: Problems in the BIMAS Program," *Indonesia* 11 (1971): 63-82.

Table 5. Harvested *Sawah* Area and HYV Programs, West Sumatra, 1965–1982

	Harvested <i>Sawah</i> Area (‘000 ha)	Program Coverage (‘000 ha)	Coverage (%)
1965	190	2	1
1970/71	247	64	26
1972/73	247	102	41
1974/75	259	121	47
1976/77	253	162	64
1978/79	261	214	82
1980/81	292	267	91
1982/83	300	297	99

Source: *Sumatera Barat Dalam Angka*, various issues.

As the table shows, by 1974 almost half of all *sawah* was included in some rice intensification program, and by 1982 almost all harvested *sawah* area in the province was involved to some extent. Areas which were highly dependent on rice for their main source of income, even those located in isolated areas, adopted the new varieties more quickly and completely than those areas less dependent on rice.¹⁷⁴

As a result of the rapid adoption of the HYVs, West Sumatra has again begun exporting rice, predominantly to neighboring Jambi and Riau.¹⁷⁵ Using a figure of about 160 kg per capita annual consumption of milled rice (303 kg paddy) in West Sumatra,¹⁷⁶ we can see that by 1985 paddy production (1,495,000 tons) well exceeded consumption (1,135,000 tons) for the 3.74 million inhabitants of West Sumatra, leaving considerable quantities available for export.¹⁷⁷

Although the program experienced some initial difficulties in conceptualization and implementation, the social and economic consequences of the HYVs in West Sumatra bear little resemblance to the negative consequences that reportedly sometimes occurred on Java.¹⁷⁸ Incomes of farmers adopting the HYVs increased relative to those of non-adopters, despite the fact that production costs with HYVs were much higher.¹⁷⁹ As

¹⁷⁴A. Benad, *Grüne Revolution in West-Sumatra*, *Bonner Studien zur ländlichen Entwicklung in der Dritten Welt*, vol. 1 (Saarbrücken: Verlag Breitenbach, 1982), pp. 110–13.

¹⁷⁵H. Esmara, "An Economic Survey of West Sumatra," *BIES* 8, 1 (1971): 44.

¹⁷⁶National average apparent consumption in 1983 was 146 kg per capita (see, L. Mears, "Rice and Food Self-sufficiency in Indonesia," *BIES* 20, 2 [1984]: 126). Apparent per capita consumption in West Sumatra has usually been higher than the national average (In 1973 it was 125 kg while the national average was 114 kg. Esmara, "Economic Survey of West Sumatra," p. 42 and Mears, "Rice and Food Self-sufficiency," p. 126.).

¹⁷⁷SBDA (1985): 61, 191. The exact amount available for export depends on the extent of postharvest losses.

¹⁷⁸See, for example, A. Schiller, "The 'Green Revolution' in Java," *Prisma* 18 (1980): 71–94; A. Birowo, "Problems of Technology and Employment in Agriculture," *Prisma* 1, 2 (1975): 36–43; and R. Husken, "Landlords, Sharecroppers and Agricultural Laborers," *Journal of Contemporary Asia* 9, 2 (1979): 140–51. For a more favorable view of the green revolution on Java, see Y. Hayami and M. Kikuchi, *Asian Village Economy at the Crossroads* (Tokyo and Baltimore: University of Tokyo Press and The Johns Hopkins University Press, 1982).

¹⁷⁹Thamrin Nurdin, "Survey intensifikasi padi sawah, analisa musim kering (MK) 1969 di Sumatera Barat," Survey Agro-Ekonomi Indonesia, 1970, p. 9; Thamrin Nurdin, "Survey intensifikasi produksi padi sawah di Sumatera Barat," Survey Agro-Ekonomi Indonesia, May 1970, p. 15; Muchlis Muchtar et al., "Survey intensifikasi padi sawah, analisa usahatani musim kering (MK) 1969/70 di Sumatera Barat," Survey Agro-Ekonomi

farmers became more familiar with the new technology their yields and income increased further. Significantly, the net result also tended not to alter the existing distribution of income in those areas.¹⁸⁰

This favorable result may be attributed to a number of factors. Of primary importance is the nature of landholding in West Sumatra. As in many other areas in Asia, larger landholders adopted the new varieties more rapidly than small farmers.¹⁸¹ However, early adopters were not able to buy up the land of non-adopters using profits from the new technology. *Sawah* in West Sumatra is subject to strict traditional laws and is not easily sold by the individual. This meant that, in the early days of the HYVs, those without the resources to take the risks of adopting an as-yet-unproven technology were able to adopt a "wait-and-see" attitude, until government programs were sufficiently developed for the small farmer to have more equal access to inputs.

Another important reason for the favorable income distribution after the introduction of HYVs was that they were accompanied by little labor-displacing technology in West Sumatra. Mechanization of land preparation has been for the most part impractical on *sawah* because of the steep terraces in many of the principal rice-producing districts. Harvest technology has also not changed. On Java, a small blade cupped in the hand called an *ani-ani* was used to harvest rice in a very labor-intensive fashion. After the introduction of the HYVs this was often replaced by the less labor-intensive sickle.¹⁸² In West Sumatra there was a version of the *ani-ani*, locally called the *tuai*, but its use was generally restricted to *padi ladang*, unterraced rainfed rice, and the sickle had been in general use for harvesting *sawah* long before the introduction of HYVs. As a result, the total demand for labor in West Sumatra rose dramatically with the larger harvests and the greater number of harvests per year,¹⁸³ turning some areas previously afflicted with surplus agricultural labor into labor-deficit areas.¹⁸⁴ Mechanization in the rice-production cycle has most commonly been in the form of simple threshing machines. These have developed in response both to the larger harvests and because less time is available for threshing, now that farmers are eager to begin soaking their land again and preparing for a second crop.

In the last three years, however, with the achievement of self-sufficiency in rice in Indonesia, rice prices have been unstable and often low, and rice farmers all over the country face new difficulties in earning a living from *sawah*. The impact of this on the construction, operation, and maintenance of irrigation systems in West Sumatra is not yet clear.

Recent irrigation development. Since 1966, the Indonesian government has promoted rice agriculture by every available means, including the construction of new irri-

Indonesia, July 1971, p. 10; Muchlis Muchtar, "Intensifikasi padi sawah musim tanam 1974 dan 1974/75 pada dua Kabupaten di Sumatera Barat," *Survey Agro-Ekonomi Wilayah Sumatera Barat*, 1975, pp. 9, 11.

¹⁸⁰P. Deuster, "The Green Revolution in a Village of West Sumatra," *BIES* 18, 1 (1982): 86-95.

¹⁸¹Benad, *Grüne Revolution*.

¹⁸²See, for example, W. Collier et al., "Tebasan System, High Yielding Varieties and Rural Change: An Example from Java," *Prisma* 1, 1 (1975): 17-35; and Y. Hayami and A. Hafid, "Rice Harvesting and Welfare in Rural Java," *BIES* 15, 2 (1979): 94-112.

¹⁸³Benad, *Grüne Revolution*, p. 89.

¹⁸⁴During my fieldwork in Lintau, Tanah Datar, farmers mentioned that before the HYVs they used to go to Limapuluh Kota to work as agricultural laborers after their own harvest. Now, with the HYVs and multiple cropping, they stay at home and actually must import labor from Tanjung Barulak, an area with poor water resources, to help with their own fields.

gation systems and the rehabilitation and improvement of existing ones. Indeed, irrigation improvement was a necessary concomitant of the government's plans for maximizing the potential of the HYVs. And, as in other spheres of development, the government designated itself the "prime mover" in the effort to improve irrigation facilities. During the first four Five-Year Development Plans (1967–1986), rehabilitation of existing systems and construction of new systems were given the highest priority in irrigation development. Central government commitment to irrigation has been extensive. As an example, in 1974/75, 44 percent of all subsidies from the central government to West Sumatra were earmarked for irrigation construction and maintenance.¹⁸⁵ By 1982, 156,000 ha were included under Department of Public Works (PU) irrigation programs in West Sumatra.¹⁸⁶ While this figure overestimates actual area, it does serve to illustrate the magnitude of the government's involvement in irrigation development in the province as compared to that of only fifteen years earlier.¹⁸⁷

The number of systems with PU involvement in West Sumatra has quadrupled from 261 systems in 1967 to almost 1,000 in 1980.¹⁸⁸ Nearly all of these systems were developed initially by farmers, many of them centuries ago. After they were assisted by the government they became de facto government systems, and the government now considers the structures to be government assets. According to PU figures, 59 percent of these government-assisted systems irrigate less than 150 hectares, accounting for 22 percent of total government-assisted *sawah* area. Another 26 percent of PU systems irrigate command areas of between 151 and 300 hectares. Only 10 percent of all PU systems in West Sumatra have designed command areas larger than 500 hectares.¹⁸⁹ The scope of government assistance to irrigation in the province is now far greater than under either colonial rule or the early post-independence government.

With the exception of certain of the largest systems, the farmers in government-assisted irrigation systems, are, in effect, free to pursue any cropping schedule they wish. During the 1950s the post-colonial government in West Sumatra attempted to continue the Dutch *plakaat sawah* tradition, but violating the *plakaat* carried no sanctions, as it had under the Dutch, and eventually a formal planting schedule was dropped.¹⁹⁰ The agricultural extension service still continues to promote simultaneous cropping to avoid pest problems, and a cropping schedule is sometimes issued from the Kabupaten-level civil administration, but the farmers are not sanctioned if they disregard the guidelines.

¹⁸⁵R. Van Leeuwen, "Central Government Subsidies for Regional Development," *BIES* 11, 1 (1975): 72.

¹⁸⁶Direktorat Irigasi, *Rekapitulasi buku pintar daerah irigasi PU Propinsi Sumatera Barat 1982* (henceforth *RBPDI*) (Jakarta: Departemen Pekerjaan Umum [DPU], 1982).

¹⁸⁷The PU estimate is of actual irrigated area (*sawah fungsional*) as opposed to design area (*sawah baku*) which is much larger. Nevertheless, the estimate of *sawah fungsional* itself appears to be too large. See Ambler, "Management of Small-scale Irrigation."

¹⁸⁸Asnawi and Shand, "Economic Impact of Irrigation," p. 110; and PU, "Inventarisasi Areal Pengairan dalam Lingkungan Dinas Pekerjaan Umum Daerah Tingkat I Sum-Bar, Tahun 1980," DPU Sumatera Barat, 1980. The latter figure refers to the official number of systems under the control of PU, but recent research indicates that some of the smaller of these, although included in PU inventories, have in fact never received any PU assistance. See Ambler, "Management of Small-scale Irrigation."

¹⁸⁹Calculated from *RBPDI*, 1983.

¹⁹⁰Examples of post-independence *plakaat sawah* for various regions in West Sumatra can be found in *Tani* 6, 7/8 (1959): 14–63. Recent attempts by PU to provide cropping schedules have been largely ineffective, according to casual accounts.

Government-assisted improvements in irrigation systems have been important in the drive for higher yields in West Sumatra, and the benefits of those improvements, at least in some systems, have more than offset the costs.¹⁹¹ Irrigation development programs in West Sumatra have not, however, been without problems, many of which stem from the difficulty in balancing the need to attend to the specific needs of individual irrigation systems with the urgent need to develop rapidly, and rehabilitate on a massive scale, the physical irrigation infrastructure, which had deteriorated through neglect and lack of funds during the 1950s and early 1960s. The pressing need to increase food production, and the availability of petro-dollars and international grants and loans to finance agricultural programs, beginning in the late 1960s, led the government to embark on irrigation programs that emphasized a top-down approach. Government officials identified systems for rehabilitation; irrigation officials or private contractors prepared the designs; contractors executed the construction of the rehabilitated facilities; and the irrigation staff was then sometimes placed in the system to perform key functions, such as operating gates and desilting canals. Farmers were often not consulted about these decisions, and they were sometimes treated as the object rather than the subject of development. This can be characterized as a "direct" investment approach.¹⁹²

The results of direct investment were sometimes unfavorable. First was the quality of construction techniques used by outside contractors, which PU staff itself was inadequate to supervise. Inevitably many structures were built whose life was far shorter than anticipated. For example, contractors often either used inferior materials or failed to follow design specifications.

A second set of problems involved designs, which were standardized wherever possible. In some cases, these designs assumed a level of management that the farmers were not willing to provide. For example, the government design provides adjustable gates at the headworks of many systems, which assumes that someone will be there to operate the gates. In designing the intake, the point where the canal takes water from the river, however, the farmer design emphasizes prevention of excessive water coming into the canal, not by the use of rising stem gates, but by the provision of a portal through which the water must flow—when the water is low the portal does not obstruct the water, and when the river water is very high, the portal blocks too much water from coming into the canal and destroying it. With this design, no personnel are needed to monitor the intake. This is one example of how a farmer design was devised to regulate water automatically, while the government design required placing of a full-time or part-time employee to watch over the gates.

A third problem derived from the specification of structures to be constructed or rehabilitated. Government projects sometimes paid little attention to what the farmers wanted done to their system. For example, the government would sometimes emphasize headworks construction even in hilly areas where farmers gave canal lining a higher priority.

A fourth set of problems arose because in many cases only selected irrigation systems along a rivercourse were improved. Sometimes the improvements enabled selected

¹⁹¹ Asnawi and Shand, "Economic Impact of Irrigation," p. 119.

¹⁹² For a discussion of "direct" versus "indirect" investment strategies in irrigation, see E. Walter Coward, Jr., "Direct or Indirect Alternatives for Irrigation Investment and the Creation of Property," in *Irrigation Investment, Technology, and Management Strategies for Development*, ed. K. William Easter (Boulder: Westview Press, 1986).

systems to divert more water from the rivercourse than had previously been possible using simpler headworks. This changed the balance of intersystem water distribution, and often led to complaints from downstream systems that improved systems upstream had begun diverting too much water.

A fifth constellation of problems revolved around the farmers' increasing reliance on the government to improve and maintain the assisted systems. Whereas before assistance the farmers used to maintain the systems themselves through various forms of collective labor, after assistance they tended either to rely on resident PU personnel, or to wait for PU to provide periodic or incidental assistance when the system needed attention. The farmers' tendency to wait for PU to do a job they could do themselves was understandable because PU now considered the rehabilitated system as a government system. Thus, improving the physical aspects of formerly farmer-managed irrigation systems inadvertently created a dependency relationship between the farmers and the government, in which local mobilization of resources and action was retarded by the government assistance itself. This situation was often compounded by the fact that little attention was paid to the development of viable water users' associations in the rehabilitated systems.

Many of these deficiencies are a consequence of not involving farmers in decisions concerning their irrigation systems. In its haste to develop the physical infrastructure, the central government in the late 1960s chose to operate through a standardized direct approach which did not capitalize on local knowledge of conditions, needs, and desires.¹⁹³ Involving farmers in the decision-making process could have assisted in identifying priorities for assistance, in developing designs appropriate to local social and ecological conditions, in involving farmers in the construction of their own system, and in strengthening farmer ownership and responsibility for subsequent maintenance of the system. Such a participatory approach, however, does require intensive communication between irrigation officials and farmers and the skills to view irrigation as a socio-technical set of phenomena, not just merely as a physical infrastructure.

Experiments with such "indirect" or "participatory" approaches to irrigation development have been few in West Sumatra in recent years. Where tried, however, this approach has proven to be less costly than the traditional direct approach, and farmers are likely to have a greater stake in maintaining the system after construction, because they were involved in the entire process.¹⁹⁴ At present, however, PU is ill-equipped to attempt this on an extensive scale.

The recent fiscal crisis has spurred efforts to redefine the government's role in irrigation development and to move toward a more indirect investment approach. Since the decline in oil and gas revenues in the mid-1980s, the national budget has no longer been

¹⁹³For a discussion of similar problems in an extensive irrigation development program for small-scale irrigation done in the 1970s, see USAID, "Sederhana: Indonesia Small-scale Irrigation," AID Project Impact Evaluation Report No. 29, February 1982. For an interpretation of one case study see S. Asnawi et al., *Sebuah studi perbandingan*, pp. 75-95.

¹⁹⁴See, for example, two projects, Bt. Kajai and Bt. Air Baling, constructed under German Technical Assistance. See "Laporan Akhir Proyek Irigasi Mini Batang Air Baling, Desa Hulu Pasaman, Kecamatan Talamau, Pasaman Barat," Area Development Project, West Pasaman, March 1987. Also, three irrigation systems were improved in West Sumatra by PU, in conjunction with funding from USAID, using a more participatory approach. For a description of the approach, see LP3ES, "Laporan akhir proyek percontohan pembinaan partisipasi petani dalam pembangunan dan pengelolaan irigasi sederhana melalui community organizer dalam rangka high performance sederhana irrigation system (HPSIS)," Jakarta: LP3ES.

able to support the rising budgets for operations and maintenance needed by PU for the large number of systems it has taken over. Consequently, the priorities for irrigation development under the fifth Five-Year Development Plan (1987–1992) lay more stress on developing efficient operations and maintenance procedures and on collecting water users' fees than on new construction and rehabilitation. In line with this change of policy, as part of a large irrigation sector loan from the World Bank initiated in 1987, PU has also begun a program of turning over all irrigation systems under 500 ha to farmer water management groups within the next fifteen years. Many of these systems will receive construction assistance before the turnover. However, in contrast with its earlier approach, PU is now experimenting with approaches involving farmers in the planning, design, and execution phases of construction. In addition, PU plans to provide assistance to farmer groups to encourage water users' associations which could operate and maintain the irrigation systems, with a minimum of government assistance after the turnover. One of the major challenges PU now faces in West Sumatra is to develop these water users' groups, given that the traditional elite, which might normally constitute the backbone of such organizations, has been weakened, in part by the government's own past non-participatory approaches to development.

It is interesting to note that, in many ways, the indirect style of assistance would mark a return to the policies of the Dutch toward small-scale irrigation during the last three decades of their rule. However, in contrast to the reasons behind the colonial policies, which were aimed largely at minimizing government expenditure, the present government's turnover policy, while also spurred by financial pressures, is in addition apparently taking into account the long-term maintenance benefits to be derived from involving farmers in the process of planning, design, and execution.

Now that the day-to-day management of many individual systems is being turned back to water users' groups, PU is also beginning to reformulate its role at the rivercourse level. This, too, recalls earlier Dutch policies; the van Tubergen report of seventy-five years ago recommended that the Dutch government play a role in rivercourse management, but not become involved in the management of small systems themselves.

Despite these positive steps, in West Sumatra irrigation development must still take place within an administrative environment which is increasingly ill-equipped to deal with irrigation as the management of a scarce resource for which different groups increasingly compete. There have been many changes in the administration of the *nagari* since World War II, involving the relationship between the *wali nagari*, the successor of the Dutch *kepala negeri*, and various forms of *adat* and people's representative councils at this level.¹⁹⁵ The most important of these administrative changes, however, came with the enactment of a law in 1979 which eliminated the *nagari* as a political unit.¹⁹⁶

The *nagari* had been composed of territorial units called *orong*. These *orong* were not independent entities and only had their fullest social meaning within the context of the *nagari*. Under the new law, each of these *orong* was converted into an independent administrative unit called the *desa*. Thus, the 543 *nagari* of West Sumatra became 3,537

¹⁹⁵See (1) Maklumat Residen Sumatera Barat, no. 20/1946; (2) Peraturan Gubernur Sumatera Tengah, no. 50/GP/1950; (3) Ketetapan Gubernur Sumatera Tengah, NO. E/G/1955; (4) Keputusan Gubernur Kepala Daerah Tk.I Sumatera Barat, no. 02/Desa/1963; and (5) Surat Keputusan Gubernur Kepala Daerah Propinsi Sumatera Barat, no. 015/G.S.B./1968.

¹⁹⁶Undang-undang no. 5, 1979. The implementation of this law took place between 1980 and 1982.

desa,¹⁹⁷ which now form the lowest political unit, directly beneath the *kecamatan* in the administrative hierarchy. Each *desa* is headed by a *kepala desa*, who receives a low salary directly from the government. Although the *kepala desa* is selected through consultation of the *pangulu* of the *orong*, his appointment is subject to ratification by the government, just as the Dutch reserved the right to approve or veto the choice of the *kepala negeri*.¹⁹⁸

In conjunction with the clan elders (*niniak mamak*), the *wali nagari* used to coordinate and promote all important development projects in the *nagari*, whether they were initiated by the government, by individuals or organizations, or by the *nagari* council.¹⁹⁹ Now, the *wali nagari* and his staff have been eliminated. Property which was owned by the *nagari* administration is being turned over to the *Kerapatan Adat Nagari* (KAN),²⁰⁰ a consultative body composed of the men who occupy positions of traditional family leadership.²⁰¹

Many problems have arisen with the breakup of the *nagari* into *desa*. The first is an increased administrative burden on the *camat*, who has to monitor the greatly increased number of political units under him. (As an example, the 9 *nagari* in Kecamatan Lintau Buo in Tanah Datar were broken up into 86 *desa* after the reorganization.) Rather than use *nagari* administration as an intermediate level to remedy this problem, the government has decided to create more *kecamatan* and thus reduce their size. Unlike the *wali nagari*, who was always chosen from among the *niniak mamak* within his own *nagari*, the *camat* is normally an outsider and therefore more removed from village-level conditions.

Although the creation of the *desa* was not supposed to eliminate the *nagari* as a social *adat* unit ("*kesatuan masyarakat hukum adat*"),²⁰² the relationship between the *nagari* and the *desa* has not been entirely clear under the new system.

The KAN (or Nagari Adat Council) was conceived as a way of dealing with *nagari* issues now that the position of *wali nagari* has been abolished. According to Perda 13, the duties of the KAN are: (1) to manage affairs which deal with hereditary titles, and property;²⁰³ (2) to settle civil cases regarding *adat* and customary law; (3) to strive to bring peace and legal authority to disputes among the members of the *nagari*; (4) to promote the culture of the members of the *nagari* in order to preserve the regional culture and enrich the treasurehouse of national culture; (5) to inventory, guard, maintain, and utilize the property of the *nagari* for the benefit of the members of the *nagari*; (6) to organize and coordinate the legal polity according to *adat* in each *nagari*, and to promote a high sense of family among the members of the *nagari*, increasing the level of social awareness and community spirit; and (7) to represent the *nagari*, and to act in its name, in all

¹⁹⁷SBDA, 1987, p. 23.

¹⁹⁸This change was preceded by the establishment of unpaid *kepala orong* or *orong* heads under the *nagari* administration. See, Surat Keputusan Gubernur Sumatera Barat, 24 December, 1974, No. 155/G.S.B./1974, paragraph 26.

¹⁹⁹See, for example, Harsja Bachtar, "Twelve Sumatran Villages" (MA thesis, Cornell University, 1959), pp. 128, 132.

²⁰⁰The turning over of *nagari* property is still taking place. The implementation of this ordinance is sometimes slowed by confusion over what exactly constitutes *nagari* property.

²⁰¹Peraturan Daerah (Perda) no. 13/1983.

²⁰²Cf. the Dutch term "*sociale gemeenschap*."

²⁰³Or *pusako*.

legal cases inside or outside the courts in matters regarding the rights and property of the *nagari*.

Apart from acting as a repository of knowledge and instruction on *nagari adat*, the primary function of the KAN then becomes the supervision of *nagari* property. However, in the government view, this "supervision" is normally limited to the utilization and inheritance of that property according to *adat*. Property improvement falls within the sphere of "*pembangunan*" ("development"), which in practice is normally considered the province of government agencies, not of *adat* institutions or *adat* leaders. Thus, while desiring the cooperation of *adat* institutions and leaders in promoting its development plans, the government has effectively removed much of the economic content from the concept of *adat*.²⁰⁴ Under the Dutch, *adat* leaders were allowed to retain a role in the administration of *adat*, which although it no longer encompassed the overall organization of society, did include the organization of the economic base of both the European-dominated sector and village economy sectors.²⁰⁵ Under the new development programs, however, *adat* leaders are increasingly left in control of *adat* merely in marginalized (that is, non-economic) sectors. The new leaders in the economic sector are not *adat* leaders but rather government civil servants.

There are several ramifications for irrigation in this administrative reorganization. First is the proliferation of administrative units now served by irrigation systems. For example, in Kecamatan Lintau Buo there were previously eleven government-assisted systems which irrigated land in more than one *nagari*. With the administrative breakup of the *nagari*, eight additional government systems now cross administrative boundaries. Some small systems now irrigate land in seven, eight, even nine *desa*. The shift in political power from the *niniak mamak* to the *desa* headmen, means that there is a tendency to parochialize the interests of the various *desa* served by these systems, raising the potential for conflict in management of the irrigation system.

Second, with the proliferation of *desa*, the problem of coordinating water use between systems utilizing the same river becomes heightened. The *wali nagari* can no longer coordinate intersystem water allocation and distribution, while the bailiwick of the *kepala desa* is too small and that of the *camat* too large to handle intersystem water allocation. Intersystem coordination of water has always been one of the weaker aspects of Minangkabau irrigation,²⁰⁶ and this administrative change has exacerbated the problem.

A third problem caused by the breakup of the *nagari* has been the reduction of manpower available for communal work projects (*gotong royong*). The institutions to mobilize labor on a *nagari* level have now been severely weakened, promoting an atomization of labor interests and a tendency to restrict *gotong royong* to the *desa* level. In the 1920s each *nagari* had an average of about 600 working men who could be mobilized for *gotong royong* by the *niniak mamak* and *wali nagari*.²⁰⁷ With the breakup of the *nagari*, landowners in one *desa* often have their land in another, so that one *desa* may have much labor for *gotong royong* but little land;²⁰⁸ while other *desa*, with large amounts of

²⁰⁴Cf. Asnawi et al., *Sebuah studi perbandingan*, pp. 90-91.

²⁰⁵See also Kahn, "Tradition, Matriliney and Change," p. 86.

²⁰⁶See Ambler, "Management of Small-scale Irrigation."

²⁰⁷C. van Vollenhoven, *Het adatrecht van Nederlandsch-Indië*, vol. I (Leiden: Brill, 1931), p. 251.

²⁰⁸For example, in Kecamatan Lintau Buo, Tanah Datar, Desa Kota Tapi Selo and Desa Nusa Indah, core *lorong* in Nagari Tapi Selo and Nagari Lubuk Jantan, are the places of residence for a large number of *niniak*

sawah owned by people outside the *desa* may now find themselves with much land but little labor. Some *desa* now have as few as 30 able-bodied men,²⁰⁹ and the diversion of *desa* labor for government-sponsored *gotong royong* projects such as village and roadside beautification programs further reduces the available labor for productive projects such as irrigation.

Conclusions

During the last 200 years, the history of rice cultivation in West Sumatra has been one of commoditization in fits and starts. Although in precolonial times limited quantities of rice had been exported to eastern Sumatra via river routes and to the western coast via overland trails, it was not until Dutch colonization and improvements in road and rail transportation that large rice movements between districts and regions became practical. However, the potential for exporting rice over these new routes was fettered by the *koffiestelsel*. Whereas, given its natural resources and skilled rice farmers, West Sumatra should have been exporting rice, in fact, by the end of the nineteenth century it had become a rice importer. The irrigation infrastructure developed by Minangkabau farmers was capable of growing surplus rice, but early Dutch policies which intentionally kept the rice economy as much as possible on a subsistence basis, undermined development of a vigorous economy which might have otherwise burgeoned under a rice surplus situation, thus restricting West Sumatra's potential for agricultural development.

The world trade depression in the 1930s forced a return to rice and other basic food crops. Although the Dutch at that time actively promoted rice cultivation, gains in production were offset by the increasing population. The rice import situation continued to worsen in the post-independence years.

Since the advent of the new rice varieties in the 1960s and 1970s, total rice production in West Sumatra has tripled. The scope for development of new *sawah* has been very limited in most of the province for at least a century, and higher yields and multiple cropping have been responsible for the huge increase in production—and for important increases in farmer incomes as well. Rice is now not only an article of consumption, but also a major article of trade, and the monetization of the rice production process has caused a major change in village economies. West Sumatra has now finally become the regional exporter of rice it should have been long ago.

The encouraging fact that production and incomes have increased, however, must be tempered by the assessment of the institutional development which should accompany such gains. *Nagari* members under the leadership of *pangulu*, acting as either lineage heads or *nagari* elders, were apparently responsible for developing the region's irrigation in precolonial times. With the possible exception of activities by the Padri in the early nineteenth century, there are no confirmed records of any supra-*nagari* political power being responsible for irrigation development during the precolonial period.

Yet this strong base of authority and cohesion in irrigated agriculture has been under continual assault since colonial times. The Dutch occupation cost the *nagari* its autonomy. The equality of the *pangulu* was eroded as the Dutch elevated some *pangulu* above

mamak and other landowners from those *nagari*, but within the two *desa* proper there are only 6 and 15 ha of *sawah* respectively.

²⁰⁹For example, Desa Duwek, Nagari Tanjung Bonai, Lintau Buo, Tanah Datar.

others to facilitate colonial governance from Padang and Batavia. Limits were put on the creation of new *pangulu*, while the Dutch also invested the existing *pangulu* with power far beyond that conferred by *adat*. The integrity of the *pangulu* was strained as the Dutch government pressured them to force their people to grow export crops for Dutch monopolies, and many *pangulu* became tools of the colonial administration. By the time the Dutch belatedly tried to separate the functions of the civil administration from *adat* leadership, the prestige of the *pangulu* had been severely eroded. Paradoxically, in trying to strengthen the indigenous Minangkabau administrative system, the Dutch undermined the very foundations of *adat*-based authority.²¹⁰

Although Indonesian governments since independence have wished to preserve the *adat* functions of the *pangulu*, they have inadvertently continued the process of "de-*adat*-ization" of leadership at the village level. Issues of "development"—including irrigation—have been increasingly moved into the hands of civil servants and out of the hands of traditional leaders. Past linkages between civil and *adat* roles are being structurally weakened as well, as evidenced by the recent abolition of the *nagari* as a unit of political administration. These events have placed traditional leadership in a passive role and have not encouraged dialogue between *adat* heads and the agents of change from government ministries. With specific regard to irrigation development, the lack of consultation which characterizes many state programs has led to a further diminution of the prestige of the *pangulu*. The irrigated rice fields of the lineage, the traditional trusteeship of *adat* leadership, are in many cases being developed by a government which is not directly accountable to the irrigators whose fields its policies affect.

The conceptual and practical disadvantages encountered from this direct investment style in small irrigation systems—and the rising operations and maintenance budget required to operate and maintain them—have recently led the government to begin a program of returning government-assisted small-scale systems to farmer water-user groups. It is hoped that this new policy will enable farmers to do what they do best—irrigate—while at the same time reorient the government's irrigation department away from the role of an administrative and executive agency and toward one of a service agency. While farmer water groups are still in a tenuous legal position, this new policy does represent a significant and positive first step in decentralizing some state control over agricultural development and moves toward empowering farmers to make decisions which affect their livelihood. Nevertheless, with the weakening of institutions for handling inter-*nagari* and intersystem water distribution, intergroup competition for irrigation water in West Sumatra is likely to continue to be a major problem.

²¹⁰See Amran, *Sumatera Barat*, pp. 187–208. Similar problems in Bengkulu are described in J. Kathirithamby-Wells, "A Survey of the Effects of British Influence on Indigenous Authority in South West Sumatra (1685–1824)," *BKI* 129 (1973): 239–68.